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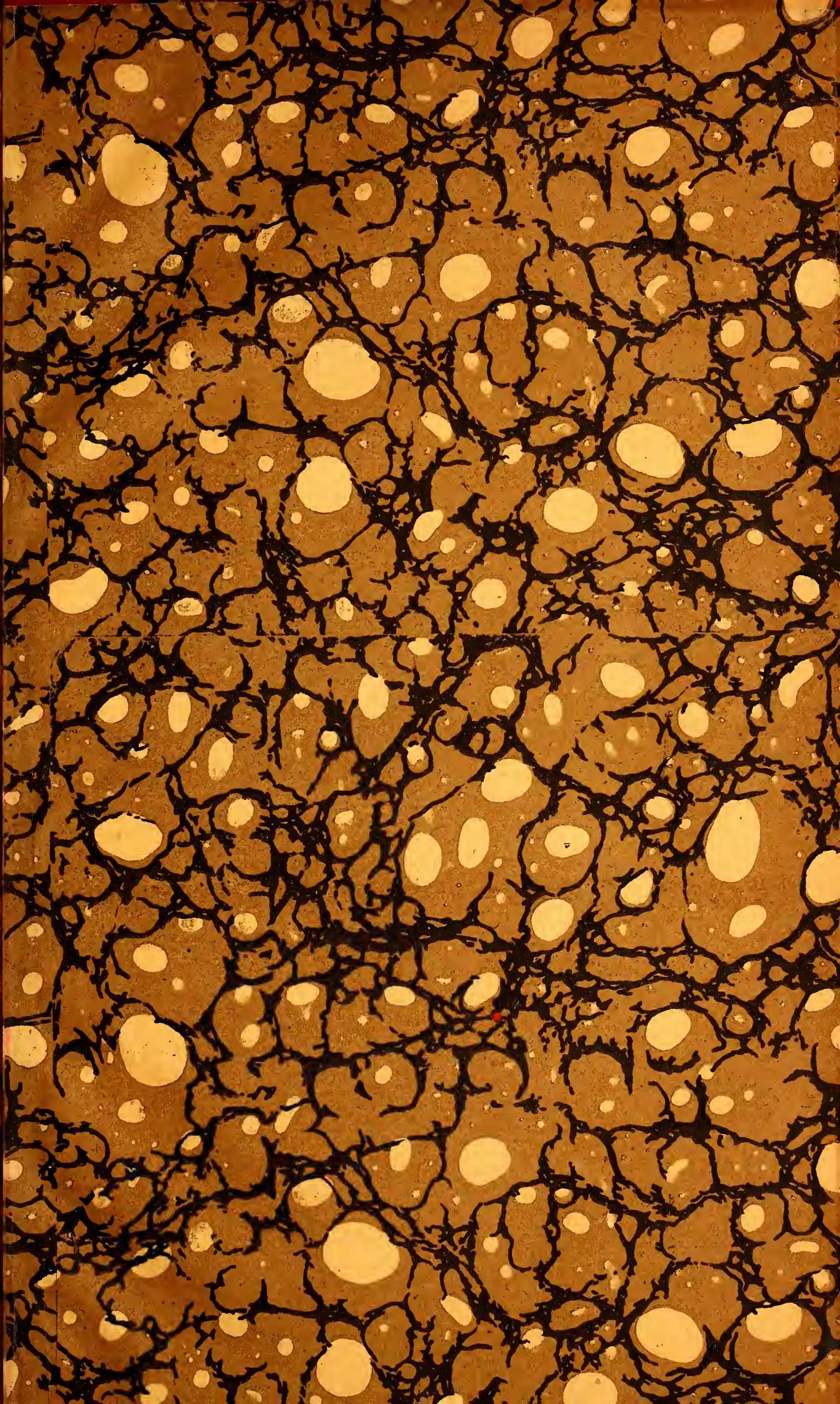

TRANSACTIONS

OF THE

SOUTH AFRICAN PHILOSOPHICAL SOCIETY.

VOLUME XVII.

1907–1908.

WITH TWENTY PLATES.

CAPE TOWN:
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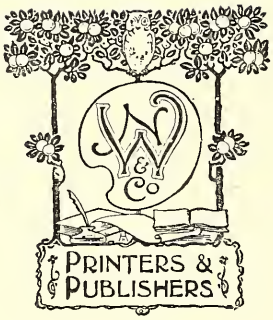

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TRANSACTIONS

OF THE

SOUTH AFRICAN PHILOSOPHICAL SOCIETY.

VOL. XVII.

THE OPISTHOBRANCHIATA OF SOUTH AFRICA.

BY R. BERGH, Copenhagen.

(With fourteen Plates)

The number of Opisthobranchiata hitherto known from the coast of South Africa is very small. Krause described a *Pleurobranchus granulatus*, Vayssière a *Pleurobranchæa capensis*, Rang a *Melibe rosea*, Stimpson a *Tritonia pallida* and a *Triopa lucida*.

The investigations of late years of the Cape Government, carried out under the direction of Dr. Gilchrist, have considerably augmented the number, and have furnished the material for the following report.

The East and South Coasts of South Africa are washed by a prolongation of the great equatorial current from the Indian Ocean; the West, on the contrary, by the cold Antarctic current. Sometimes, however, it happens that the warm Agulhas current passes up this side, while at other times the cold Antarctic current passes further to the East.* In general there is a marked difference

* Gilchrist, "Observations on the Temperature and Salinity of the Sea around the Cape Peninsula." Mar. Inv. I., 1902, pp. 181–216.

Gilchrist, "Currents on the South African Coast, as Indicated by the Course of Drift Bottles," part ii. 1904, pp. 155–166.

between the fauna of the West side of the Cape of Good Hope Peninsula and that of the East. The latter has more of a tropical Indian character, the former a somewhat more Northern, although typically tropical forms of Nudibranchiata (*e.g.*, the Melibe) are not wanting.

TECTIBRANCHIATA.

ANASPIDEA.

APLYSIIDÆ.

Aplysiidæ propriæ.

I. Aplysia, L.

Linné, Syst. Nat., ed. xii., 1767, p. 1072.
Cuvier, Tableau Elém. (1798) an v., p. 386, pl. ix., fig. 3.
Lamarck, Syst. des Anim. s.v. 1801, p. 62.
R. Bergh, Die Opisthobranchiata der Siboga Expedition, 1905, p. 3.

1. Apl. Gilchristi, B. n. sp.

Animal colore brunneo albo-maculato.

Pl. I., figs. 1–3 ; Pl. X., fig. 1.

A living specimen was procured in False Bay in February, 1905 (Pl. X., fig. 1). It was brown in colour, the sides of the foot with many small white spots and white border, the outer border of the wings with larger white blotches, and many fine black perpendicular lines on their outer side. It swam dexterously and at a fair speed through the water.

The animal, in a contracted condition (preserved in formalin), had a length of 6·5 cm. and, with raised parapodia, a height of 3 and a breadth of 2·5 ; the breadth of the head (with its 7 mm. long tentacles) 2 cm., the height of the rhinophores 6 mm., the length of the mantle-shield 2·5 cm., its breadth 2, the length of the sipho 1, the breadth of the foot proper (sole) 9 mm., the length of the tail 8, the length of the foot-wings 4 cm., with an inside height of 1·7.— The colour of the sole of the foot is blackish brown with a whitish margin, the animal otherwise of a dark brown colour, whitish rather elongate spots on the sides of the body, some also on the outside of the wings and a series of larger blots along the margin, the inside of the wings of the same brown colour with a few whitish spots towards

the whitish margin, the mantle and the sipho of somewhat brighter brownish colour with spread roundish whitish spots.

The animal has large, rather flattened tentacles, the sole of the foot not narrow, with distinct margins, the wings high, meeting behind and connecting with the tail; on the mantle no aperture could be detected, the somewhat grayish gill 22 mm. long by a height of 10 and a thickness of 6, nearly its half freely projecting, the number of groups of lamellæ about 15.

The *shell* 2·3 cm. in length with a breadth of 2 and a height of about 0·5; of quite usual form, with a thin calcified, very fragile layer and a rather large cuticular margin.

The eyes of a diameter of about 1 mm.

The length of the mouth tube 3 mm. The *bulbus pharyngeus* grayish, 9 mm. long, with a height and a breadth of 6. The mandibular plates larger, meeting above and beneath, 4·5 mm. high with a breadth of 2·25; their full anterior half black brownish, the rest yellowish; their staff-formed elements up to at least 0·2 mm. high by a diameter at the slightly thickened upper end of 0·016. The gray palate as usual, its plates with the usual thin hooks of a height of up to at least 0·2 mm. The brownish yellow rasp of the broad tongue containing about 36 series of plates, in the short and thick sheath 10 series, the total number thus being 46; in the series up to 33 plates. The plates in the thicker parts yellow; the breadth of the median 0·28 mm.; the 4 outermost measured 0·08–0·12–0·18, and 0·25 mm., the length then rising to 0·35 by a height of 0·24 mm. The median plate (Pl. I., fig. 1) not broad, with finely denticulated hook and two denticles at its root. The two outer plates (fig. 2*a*) without hook, the next with a small single one, the following with denticular hook (fig. 2). The plates otherwise of the usual form, with pointed finely denticulated hook and a stronger denticle towards its root or (on the outside) with 2–4 (fig. 3).

The long thin white salivary glands as usual.

The black œsophagus 10 mm. long by a breadth of 1·25. The first stomach nearly colourless, 14 mm. long by a diameter of 10, empty. The *masticatory stomach*, brownish gray, 8 mm. long by a diameter of 6, two series of rather low thorns before the cardia, the facets of the stomach as usual, with 8 larger and about 6 smaller plates, the larger of about the same size, of a height of 3·5 mm., dirty yellow, the smaller paler, less regularly pyramidal. The third stomach 5 mm. long and broad, without facets, as it were.

The brownish gray conical *liver* 14 mm. long by other diameter of 9, the end of the long (about 4 mm.) gall-bladder freely projecting on the surface of the liver.

The yellow *hermaphrodite gland* covering the end and the hinder upper side of the liver with a layer 4 mm. thick, 8 mm. long, and 7 mm. broad, its duct long and strong. The yellowish white and grayish anterior genital mass as usual, the grayish globular spermatotheca 6 mm. in diameter. The brownish gray *penis* 11 mm. long by a diameter of 2·25, nearly cylindrical, the inside of the præputium with strong blackish longitudinal folds; the white glans 7 mm. long, very pointed, somewhat turned, with rather deep furrow.

2. Apl. allochroa, B. n. sp.

Pl. I., figs. 4–10.

Two individuals of nearly the same size were caught at Knysna at low tide on the shore between the jetty and the village. One of them gave off a good deal of red pigment.

The length was 25 mm. with a breadth of 10 and a height of 11, the oval mantle 12 mm. long, its round hole of a diameter of 8, the sipho 4 mm. long by a breadth of 3, the length of the somewhat flattened gill 5 with a breadth of 2 mm.; the foot 4 mm. broad, the wings 13 mm. long, their height (on the inside) 5, the length of the tail 4. They were one-coloured, yellow, merely the cleft of the rhinophores and the tentacles black and on the free inner margin of the foot-wings a series of small black spots, the gill slightly brownish.

The skin quite smooth all over. The foot-wings coalescent behind. The under-side of the mantle brim brown, richly provided with small glands. The shell (fig. 4) very difficult to see and to loosen, 11 mm. long with a diameter of 9, very flattened, very thin cuticular, with small nucleus, without any trace of calcification, nearly colourless.

The central nervous system as usual.

The *bulbus pharyngeus* dirty yellowish, 5 mm. long with a breadth of 3·5 and a height of 3; two grayish, as it were, palate plates shone through the roof of the mouth cavity, but no trace of armature could be detected. The longish triangular mandibles brown, anteriorly nearly black, 1·75 mm. high by a breadth up to 1, their elements (fig. 5) up to 0·18 mm. in height by a diameter of 0·009. The rasp of the tongue yellowish brown, containing 22 rows of plates, in addition 15 in the sheath, the total number of the series thus being 37; about 20 plates in the rows. These last with exception of the 2·3 outer brownish yellow; the length of the 6 outer (fig. 8) was 0·06–0·08–0·1–0·12–0·18–0·25, and seemed not to become higher, the breadth of the median plates 0·35 mm. These last (fig. 6) with

finely denticulated hook and at the base of this two pointed denticles. The first lateral plates (fig. 7) with strong hook finely denticulated on the margins and at its base two strong denticles. On most of the lateral plates the margins of the hook were even, but at its base two pointed denticles on each side; the 4–5 outer (fig. 8) had no hook.

The salivary glands as usual.

The first stomach 8 mm. long by a diameter of 7, at its pylorus two series of irregularly roundish facets. The masticatory stomach brownish, of a diameter of 3 and a length of 2·5 mm., showing 9 larger and 4 smaller plates, all yellow, the first up to 1·5 mm. high, of the usual pyramidal form, the later partly more conical (fig. 9). The third stomach 2 mm. long, around its cardiac opening a few rounded tubercles; but no thorns could be found. The liver brownish gray, sackformed, 10 mm. long by diameter of 6.

The *hermaphrodite gland* in colour scarcely differing from the liver, in the male and female lobules ripe genital elements. The somewhat compressed anterior genital mass about 5 mm. long, whitish and yellowish, the sperm-oviduct 6 mm. long. The penis (fig. 10) straightened out 6 mm. long, yellowish, the white glans in its hinder end 1 mm. long, to its posterior end a small prostata gland seemed affixed (fig. 10).

This form represents perhaps a new species.

3. Apl. gargantua, B. n. sp.

Pl. I., figs. 11–21; Pl. II., fig. 1.

One individual was taken on the beach at Simon's Town (2.11.99).

Preserved in formalin it had a length of 18 cm. by a breadth of 7·5 and a height of 6·7 cm., the length of the side of the head from the mouth to the end of the tentacles 3 cm. (on each side) by a breadth of 1·8, the tentacles and the rhinophores 7 mm. long. The mantle 7·5 cm. long by a breadth of 4·5, its sipho 2·8 cm. long with a breadth of 1·8. The gill is of a length of 4 cm. with a height of 2·2, and a breadth of 2, the number of tufts of lamellæ on each side about 15. The foot-wings (parapodia) reaching from the region behind the rhinophores to the tail, the height of the wings on the inside up to 3·5 cm.—The ground colour of the whole of the back with the wings and mantle clear brownish gray with very many irregular rather large white spots, the upper half of the inside of the wings coloured in the same way here as on the mantle, the spots often confluent in large patches, the lower part of the inside of the wings whitish, the sides of the body grayish, the foot dirty yellowish white.

The form of the animal as usual, the fore end of the head rather large, the tentacles proper and the rhinophores rather small, the male genital opening at the root of the (right) head-wing (about 9 mm. from the mouth). The seminal furrow very distinct, the vulva rather thick. The mantle a little convex, without hole (to the shell); the posterior third of the gill freely projecting, the anal aperture flat, the branchio-pericardial on usual place. The margin on the foot-wings finely crenulated, the foot rounded anteriorly, with pronounced marginal furrow.

The shell measured (floating in water) 6 cm. in length by a breadth of 4, the height was about 7 mm.; it was quite cuticular, somewhat yellowish, without trace of calcification, the nuclear part very small (fig. 11).

The cavity of the body extends to the root of the tail.

The central nervous system as usual.

The mouth tube 8 mm. long, grayish, darker on the inside. The *bulbus pharyngeus* 17 mm. long with a breadth of 13 and a height of 12 mm., whitish with gray palate, the thick rasp-sheath forming a prominence on the under side. The mandibles 9 mm. high with a breadth of 4·5 and a thickness of about 0·3, the posterior margin convex, the anterior somewhat concave; the colour brownish yellow, the anterior half darker; the elements high, rather straight, up to 0·3 mm. long (fig. 12) with diameter of 0·007 mm. The median part of the palate as usual, the thorns of the lateral parts thin, colourless, somewhat bent, of a height up to 0·20 mm. (fig. 13). The large tongue with brownish yellow rasp; the whole organ was so hardened that a proper examination was impossible; the rasp contained perhaps about 30 and the sheath about 12 rows of plates. The median plates could not be seen; the length of the body of the six outer laterals was 0·04–0·08–0·10–0·20–0·25 and 0·30 mm., and did not seem to be more; that of the innermost scarcely exceeded 0·25 mm.; the colour of the plates yellow. The lateral plates (figs. 14–16) nearly of the usual form, with long pointed hook, whose inferior half bore denticles, larger on the outer margin, the upper half with some very fine denticles. The outer plates are much smaller, nearly or quite reduced to the basal plate (fig. 15*a*).

The salivary glands a little depressed, yellowish white, about 4 cm. long, with a breadth in the anterior part of 2 mm., their duct very short.

The œsophagus (Pl. II., fig. 1*a*) rather dark gray, 2 mm. long with a breadth of 5. It dilates suddenly in (fig. 1*b*) the anterior stomach, which is somewhat bent, before smooth, and with some (5) strong circular bands. The length of this rather stiff, somewhat cylindrical

stomach was 3·5 cm. with a diameter of 1·6 (the gray folds of the œsophagus continued through the foremost part of the stomach. Its cavity was filled with long, whitish, somewhat ramified threads of an alga of a diameter mostly of 0·5–0·75 mm.). The second, masticatory stomach 1·3 cm. long by a diameter of 2 (fig. 1*c*); in the cardia a belt of smaller plates, set in 3–5 irregular quincunx-series (figs. 17, 18); behind these the two series of larger plates (fig. 17*b*); these last of a dirty brown colour, mostly of the pyramidal form, sometimes (fig. 18) more hornlike, rising to a height of 8 mm.; the plates of the cardial belt smaller, less regular, sometimes pointed-conical rising to a height of 4 mm. The third stomach (fig. 1*d*) 2 cm. long by a diameter of 2·3, its wall thinner than that of the two other; it passes immediately in the intestine (fig. 1*e*), which has a diameter of 7·5 mm., and as usual runs in the surface of the liver.

The liver blackish gray, black in section, 4·5 cm. long by a height of 3 and a breadth of 3·5 cm.

The hermaphrodite gland placed obliquely on the hinder end of the liver whitish, of a breadth of 3 cm., with a height of 2, and a thickness up to 1·2 cm., rather smooth on the free side; in the lobules ripe genital elements. The duct rather short, of a diameter of 4 mm., forming an ampulla with short windings, extending along the whole side of the anterior genital mass. The anterior genital mass large. The muco-albuminous mass oviform, of a length of 20 by a diameter of 11 mm., yellowish in the posterior two-thirds, with some (4) grayish spirally circular bands. The strong, nearly cylindrical spermoviduct nearly as long as the whole gland by a diameter of 8 mm., the under half brown, the upper yellowish. The spermatotheca globular, of a diameter of 9 mm., its duct a little longer. The penis a little bent (Pl. I., fig. 19), 15 mm. long, at its hinder end a strong retractor. This hinder end globular, of 3 mm. diameter, whitish; the rest, the præputium, 12 mm. long, grayish. The inside of the præputium darker, with longitudinal folds, of which two stronger are continued in the furrow of the glans; from the bottom of the præputial cavity projected (fig. 20) the pointed head of the glans, showing a furrow, which is continued up into the small cavity of the rest of the glans (fig. 21); in retracted state of the penis situated behind the præputium (fig. 19*a*), it did not show any glandular structure.

This form may represent a new species.

4. Apl. lobata, B. n. sp.

Pl. II., figs. 8–12.

One specimen was procured from Woodstock beach (Table Bay); it was preserved in a rather contracted condition.

It was 3 cm. long with a breadth of 2·5 and a height of 2; the length of the mantle shield 2·3 with a breadth of 1·7, the length of its hole 6 mm., the sipho about 8 mm. high with a breadth of 10, the height of the foot-wings (on the inside) 14 mm., the breadth of the foot 9 mm. The animal was dirty yellowish white in colour.

The foot-wings with grossly undulated margin. They both showed at about the middle of their length a perpendicular fissure with a smaller one before and behind. They coalesced posteriorly, and in front nearly covered the head with a prominent lobe 8 mm. long. The mantle very large and prominent; the gill bent, 13 mm. long, with a breadth of 7 and a thickness of 4. The whole body was quite smooth.

The shell (fig. 8) of usual form, 2·2 cm. long with a breadth of 1·7, very thin, its calcareous layer broken in many small pieces.

The foot-wings were of curious form, lobed and both so symmetrical that it scarcely could be by mutilation. The gill with about twelve compound pairs of lamellæ, the last third freely projecting, the anus and the renal pore very distinct.

The *bulbus pharyngeus* 8 mm. long with a breadth and a height of 6; the mandibular plates 1·5 mm. broad, dirty yellow, their elements (fig. 9) somewhat bent, of a height up to 0·22 mm. with a diameter of 0·013, a little flattened at the point. The palate thorns erect, plump, of a height up to 0·06 mm. The brownish yellow rasp of the tongue contained 32 series of plates, in the sheath 18, the total number of plates being therefore 50, the number of plates in the series 15. The plates yellow, the median 0·35 mm. broad, the length of the basal part of the four outer lateral plates 0·06–0·10–0·14–0·20 mm., and mounting up to 0·30, that of the first (inmost) 0·28 mm. The median plates (fig. 10) with three denticles at the base of the finely denticulated hook; the lateral plates (fig. 10) with finely denticulated hook, with one denticle at the inside of its root, with 2–3 on its outside; the 3(–4) outer lateral plates (fig. 11) without hook.

The masticatory stomach small, 4 mm. long with a diameter of 4; it showed about five clear yellowish white pyramids of a height of about 2·5 mm.; close at the cardiac end 2–3 series of small roundish tubercles. The liver yellow.

The penis (fig. 12) 9 mm. long, no armature.

This form seems to represent a definite species.

5. Apl. eusiphonata, B. n. sp.

Pl. III., figs. 5–15.

Of this form one specimen was procured in May, 1902, at East London.

It had a length of 8·5 cm. by a height of 5 and a breadth of 4·5; the height of the rhinophores and tentacles was 5 mm., the length of the foot-wings was 6·5, their height (on the inside) 2 cm.; the length of the mantle 3·3 cm., the breadth 2·4; the height of the large sipho 2·2 cm., its breadth at the base 2·6, at the upper end 1·2 cm.; the breadth of the foot 2 cm.—The ground colour of the upper side, whitish, the head and the neck blackish, due to black partly confluent stripes; the outside and inside of the foot-wings with spread rather large irregular black spots; the mantle clear grayish with a few black spots and some black stripes radiating from the centre; the foot clear dirty yellowish.

The form as usual. The foot-wings large, reaching to the root of the very short tail, their margin very slightly undulated, the outside and the inside quite smooth. The mantle of oval circuit, the anterior end a little more pointed, on the centre of the somewhat convex upper side there may be a fine opening; the sipho (figs. 5, 6) very large, embracing a great part of the upper side, fixed to the hinder wall; the anus was seen in the upper part of the siphonal channel; the large mantle quite covered the gill with exception of its pointed end (fig. 6). In the mantle *no trace of a shell could be found.* The somewhat brownish gill strongly curved, the chorda measured 14 mm., its height 11, its thickness 6 mm., on the underside a broad furrow between the lamellæ; its last fourth freely projecting.

The central nervous system as in other true Aplysiæ; the pleural ganglia not half as large as the pedal, lying next to these and before them.

The length of the mouth tube 5 mm. The *bulbus pharyngeus* 10 mm. long by a height and a breadth of 8. The hooks of the gray palate as usual, somewhat grayish, as much as 0·20 mm. high (fig. 8). The mandibular plates strong, brown, broader in the upper end, 4 mm. high by a breadth of 2·5 and a thickness of 0·25 mm.; their high elements (fig. 7) of a diameter of 0·009 mm. The tongue with brown rasp, containing 28 rows of plates, in the sheath 18, the total number of rows being thus 46; the number of lateral plates on each side of the median about 26. The plates were yellow, only the outer nearly colourless; the breadth of the median 0·25 mm.; the length of the body of the first lateral 0·25, the length

rising to 0·30 mm., the body of the four outer measuring 0·10–0·14–0·18–0·29 mm. in length. The median plates (fig. 9) somewhat plump, their legs rather short, their hook strong, and denticulated along the margins; the lateral plates (figs. 10–12) of the usual form, the strong hook with 4–5 denticles at the root of the outer margin, the point with fine denticles, mostly somewhat stronger on one margin; the 4 outer smaller (fig. 13), two without any trace of a hook, and the next with a short one without denticles.

The grayish œsophagus 6 mm. long. The yellowish first stomach somewhat curved, 17 mm. long by a diameter of 10. The *masticatory stomach* 6 mm. long by a diameter of 10·5; it showed arranged in usual way 10 larger plates and in front 8 smaller; the plates of usual form, pyramidal, of reddish brown colour, of a height up to 4 mm. The *posterior stomach* 8 mm. long by diameter of 7; in its cardiac part fine folds, on the pyloric margin a series of yellow conical and pyramidal plates, 1–1·5 mm. high, always with broken or worn point (fig. 14).—The gray contents of the stomachs formed of different algæ, undeterminable detritus and very small sand-particles. The intestine as usual.

The dirty dark-gray *liver* nearly globular, 2·4 cm. long by a breadth of 2·2 and a height of 2 cm.

The yellowish white *hermaphrodite gland* about 14 mm. broad by height of 12 and a thickness of 4; its duct running with its short windings along the whole of the under-side of the *anterior genital mass*. This last, the albumino-mucous gland, 8 mm. long by a height of 5 and a breadth of 4, yellowish white with the usual spiral white band. The sperm-oviduct a little curved, 8 mm. long by diameter of 2, quite as usual; the short pyriform spermatotheca 3 mm. long, the spermatocysta half as large. The yellowish *præputium* (fig. 15*a*) 8 mm. long, the retracted glans bent, 4 mm. long, more whitish, with transparent furrow, with strong retractor muscle. The inside of the præputium grayish, in front black, nowhere in the penis any trace of armature.

6. Apl. poikilia, B. n. sp.

Pl. II., figs. 20–21; Pl. III., figs. 1–4.

A single specimen was found at Kalk Bay (in Simon's Bay); it had coloured the preserving fluid brownish.

It was 7 cm. long by a breadth of 3 and a height also of 3 cm.; the length of the tentacles and of the rhinophoria 8 mm.; the length of the foot-wings 4 cm., by a height on the inside of 1·3; the length of the mantle 3 cm. by a breadth of 2·2; the foot was 1 cm. broad.—The ground colour of the upper side was grayish white, but for the

most part disappearing through large confluent or anastomosing irregular black spots; the mantle with strong spots and stripes radiating from about the centre; similar markings occurred on the upper part of the inside of the foot-lobes reaching to their margin, the rest being grayish white, as were also the side parts of the body adjoining the mantle; the foot grayish white.

The form of the usual type, the foot-lobes free as far as their hinder end; the mantle without hole; the siphonal mantle-fold rather flat, 6 mm. long by a breadth of 2·2; the gill as in the former species.

The shell 22 mm. long by a breadth of 20 and a height up to 4 mm. (fig. 1); the cuticular margin rather broad, else the shell was yellow, rather solid, with a prominent nucleal part.

The grayish *bulbus pharyngeus* short, pear-formed, 10 mm. long by a breadth and height of 9. The mahogany brown mandibles strong, 5 mm. high by a breadth of 3; their elements (with a diameter of 0·007 to 0·30 mm.) high, thin, their upper point bent (fig. 20). The palatal hooks nearly colourless, weak and thin, reaching to a height of 0·24 m., by a diameter at the base of 0·035 (fig. 21). The strong *tongue* contained in the yellow rasp 32 series of plates, in the sheath 22, the total number of the series being thus 54. The 6 foremost series were very incomplete and the plates mostly damaged; the 6 hindermost in the sheath not quite developed. The number of lateral plates on each side of the median was 25. The plates were yellow, the breadth of the median (between the legs) 0·28 mm., the length of the first lateral 0·26. The median plates (fig. 2) of usual form with serrulated hook, and on either side of it two denticles. The inner lateral plates (fig. 3) were also of the common form, with serrate hook and two denticles at its base (fig. 4).

The œsophagus was developed posteriorly into a proventricle. The *masticatory stomach* nearly cylindrical, 9 mm. long, with the usual armature, the plates faint yellowish. The grayish-brown *liver* 28 mm. long by a height and breadth of 17.

The *hermaphrodite gland* yellowish white, 15 mm. broad by a length of 10 and a thickness of 4–5 mm. The *anterior genital mass* yellowish white, 15 mm. long by height of 7 and a thickness of 4 mm.; the yellowish-white spermatotheca globular, of a diameter of 9 mm., the pear-formed spermatocysta 2·5 mm. long. The grayish *penis* somewhat bent, 15 mm. long; the more whitish glans conical, 4 mm. long (without armature).

The colour of the animal, its mandibles, and perhaps the nature of the palatal hooks seem to indicate a definite species.

7. Apl. Woodii, B. n. sp.

Pl. II., figs. 13–19.

Together with a specimen of *Doridium capense*, one individual of this Aplysia was procured on the shore, East London (23.5.1902).*

The furrow of the rhinophores and tentacles was velvet-black, otherwise the animal was whitish with scattered traces of gray. Its length was 3 cm. by a breadth of 1·7 and a height of 1·6; the length of oval mantle 12 mm., the length of its oval hole 5, the length of the sipho 5, the gill 14 mm. long by a breadth of 4; the length of the foot-wings 18 mm. by a height (on the inside) of 7.

The end of the sole of the foot was developed in a strange way, perhaps pathologically. It formed, as it were, a roundish disc (fig. 13) of a diameter of 9 mm., a little elevated and limited to the rest of the foot on the sides and in front. The wings of the foot passed one into the other behind; the strong sipho broadly gaping; the large pallial gland with cells of uncommon size.

The rather flattened *shell* (fig. 14), of a length of 13 by a breadth of 8 mm., very thin, cuticular with very slight and spread traces of calcination, with a small uncalcified nucleus, somewhat pointed in front.

The central nervous system quite as in other true Aplysiæ.

The mouth tube on the outside and the inside dark gray. The *bulbus pharyngeus* 7 mm. long by a breadth of 4 and a height of 3·5. The mandibles dirty yellow, 3 mm. high by a breadth of 2; their elements (fig. 15) reaching a height of 0·25 by a diameter of 0·013. The rasp of the *tongue* yellow, perhaps containing 19 and the sheath 18 rows of plates, on each side of the median plates probably about 30 lateral. The plates yellow; the breadth of the median 0·24 mm.; the length of the basal plate of the first lateral 0·20, of the second 0·023; the length of the four outermost 0·05–0·08–0·08–0·13 mm. The median plates (fig. 16) broad, with short and broad hook, which is serrated as far as the pointed end; the three outermost lateral plates (fig. 19) small, without hook; the other plates are similar in form, have a very pointed hook with a strong denticle on each side; the innermost (fig. 17) had moreover some finer denticles on the outer margin of the hook, which were absent on the rest (figs. 18, 19).

The white salivary glands quite as usual.

The pharynx gray. The œsophagus whitish, 10 mm. long by a diameter of 4. The first stomach 4 mm. long and broad, at the pylorus

* It is named after Mr. John Wood, East London, who has rendered valuable service in the discovery of this and other marine animals new to science.

two series of (about 10) short cones. The *masticatory stomach* 4 mm. long by a diameter of 5; its armature as usual, but the pyramids were nearly all gone; these were of the usual form, clear yellowish, transparent. The third stomach 5 mm. long by a breadth of 3·5; at its cardiac end distinct round impressions left by cones, which were absent.

The grayish brown liver irregularly globular, its greatest diameter being 10 mm.; the gall-bladder whitish.

The white hermaphrodite gland 4 mm. broad by a height of 3 and a thickness of 2, somewhat meniscus formed; in its lobules ripe genital elements (zoosperms). The penis whitish, grayish in front. The conical white glans 1·5 mm. long.

This form seems allied to the Apl. Sibogæ (*l.c.*, 1905, p. 9, taf. vi., figs. 36–42; taf. vii., figs. 1–6).

8. Apl. monochroa, B. n. sp.

Pl. I., figs. 22–24; Pl. II., figs. 2–7.

Three specimens were procured at Hermanus on January 15, 1897. Two individuals were dissected.

They were of about the same size, and otherwise resembled each other, were uniformly white, except that the inside of the rhinophores and tentacles was blackish brown.

The largest one was 4·5 cm. long by a breadth of 2 and a height of 2·5; the foot-wings reaching to the head, 2·5 c.m. long by a height (on the inside) of 1; the length of the oval mantle-hole 7·5 mm. (fig. 22), the white foot 10 mm. broad.

The form was as usual; the whole of the back quite even. The *shell* rather variable in form, thin, in one specimen quite cuticular, in another merely in the two posterior thirds slightly calcified, 18 mm. long by a breadth of 16, rather depressed (fig. 2). Near the hinder end of the mantle-hole, a little to the right, the mantle sends out a sort of siphonal (expiratory) fold separated from the free mantle margin protecting the gill (fig. 22). The curved whitish *gill* 13 mm. long by a height up to 8 and a breadth to 4·5 mm., the rhachis rather strong, on each side about 18 tufts of lamellæ; the gill projecting freely by about a third. The foot rather narrow, somewhat broader in front.

The mouth tube 4 mm. long. The whitish *bulbus pharyngeus* 6·5–7 mm. long by a breadth and a height of 6; the yellowish mandible-plates not broad, their thin elements of a height up to 0·12 mm. by a diameter of 0·007 (fig. 23). The palate in the middle with the usual network with glands; the palatal plates weak, with

thin, colourless hooks (fig. 24) up to the height of 0·08 mm. by diameter of 0·007–0·016.

The rasp of the strong *tongue* yellow, with 18–19 series of plates, in the sheath 17–18, the total number of series thus being 35–37. In the series 17–18 lateral plates on each side of the median. The plates yellow, the median 0·28 mm. broad; the length of the four outermost 0·6–0·14–0·16–0·20. The median plates (fig. 4) of the usual form, with finely denticulated hook and 2–3 denticles at its base. The lateral plates of the usual form (figs. 5–7), the three outermost without any trace of hook, the next with a rudiment, the following of the usual form, but the hook without denticles, which begin on the sixth to eighth (figs. 6–7).

The œsophagus in its posterior half developed into a proventriculus. The *masticatory stomach* nearly cylindrical, stiff, 3 mm. long by diameter of 4; in both individuals eight larger pyramids, bright yellowish up to 2 mm. high, and four smaller, more irregular, mostly bluntly conical.

The *liver* yellowish white, on section yellow, 2 cm. long by a height of 1·5 and a breadth of 1·3–1·5; a small whitish gall-bladder was very distinct.

A branchio-renal pore was very distinct deep under the root of the gill. The sub-branchial gland well developed.

The hermaphrodite gland white. The proper albumino-mucous mass 9–10 mm. long by a height of 7–9 and a thickness of 4; the sperm-oviduct 10 mm. long; the globular spermatotheca of a diameter of 5 mm. The penis long, whitish, at its hinder end a small, apparently glandular, appendix (fig. 3*a*). (No armature, neither of the small whitish glans nor of the præputium.)

The form here examined seems to represent a new species.

II. Dolabella, Lam.

Lamarck, Syst. des Anim. s. Vert., 1801, p. 62.

Cuvier, Mém. sur la Dolabella &c., Ann. du Mus. v., 1804, p. 435.

Rang, Hist. Nat. des Aplysiens, 1828, pp. 45–49, pl. i.–iii., xxiv., fig. 1.

Bergh, Die Opisthobranchiaten der Siboga-Expedition, 1905, pp. 13–20.

Corpus postice latius oblique truncatum; parapodiis brevioribus, apertura branchiali breviori angustiori. Testa pro majore parte nuda, fortior, nonnihil securiformis, margine sinistro crassiori, postice angustior, dextrorsum emarginata et parte nucleali deorsum incurvata carina postica prominenti instructa.

Systema nervosum ut in Aplysiis propriis. Radula (linguæ) dentibus medianis elongatis, dentibus lateralibus numerosis non denticulatis.—Glandula hermaphrodisiaca hepati non connata.

This animal, with its peculiar form, was first noticed by Rumph (D'Amboin. Rariteitkammer, 2 ed., 1741, N. x., N. 5), who figured the animal as well as its shell, but without any description. On the figure of the shell, given by Rumph, Lamarck established the genus Dolabella, which was adopted by Cuvier and afterwards by malacologists.

The form of the animal is quite peculiar, differing from that of all other Aplysiidæ; it is posteriorly broader, and terminates in a roundish oblique large disk, to the middle of which the rather narrow, longish branchial slit is continued. The somewhat dolabriform shell well calcified, with thickened left margin; the hinder part narrower, its right margin is notched; the hind end thicker, bent downwards and to the right, with a sharp, prominent keel.

The central nervous system as in the Aplysiæ proper.

The rasp (of the tongue) has longish median plate and long series of undenticulated lateral plates.

The hermaphrodite gland not coalescent with the liver.

The genus seems confined to the Red Sea, the Indian and Pacific Oceans.

As the form called by Cuvier *Dolabella Rumphii* cannot now be determined, this name must be reserved for the form figured by Rang. This author has, moreover, drawn up a small series of species (*D. Hasseltii*, *Teremidi*, *ecaudata* * (*truncata*), and still others have been named by Ehrenberg, Qouy and Gaimard, Sowerby, Stearns (*D. Hemprichii*, *tongana*, *elongata*, *californica* †); some of them are merely established on the shell, which is rather variable in form, and some are very likely merely varieties of a very widely distributed species.

Dol. Rumphii, (Cuv.) Rang, var.

(*D. Rumphii*, Cuv., *l.c.*, p. 437, pl. xxix., fig. 1.)

D. Rumphii, Rang, *l.c.*, p. 46, pl. 1.

Aplysia tongana, Q. et G., Voy. de l'*Astrolabe*, ii., 1832, p. 305, pl. 23, figs. 6–7.

* V. d. Decken, "Reisen in Ostafrica," iii., 1869; v. Martens, "Mollusken," p. 65: *Dolabella ecauda*, Rang (Zanzibar).

† Tryon and Pilsbry, "Man. of Conchology," xvi., 1895–96, pp. 151–160.

Dolabella Hasseltii, Fér. Eliot, Notes on Tectibr. and Naked Moll. from Samoa. Proc. Ac. Philadelphia, 1899, p. 515, pl. xix., fig. 3.

(*Dolabella callosa*, Lam. Syst. des Anim., s. v. 1801, p. 62.)

Dolabella Rumphii, Cuv., Rang. Bgh., *l.c.*, 1905, pp. 13–20; taf. vii., figs. 22–40; taf. viii., figs. 1–7 (9).

Pl. XIV., figs. 10–20.

One specimen was procured at East London and preserved in formalin.

The length of the individual was 12 cm. by a breadth of 9 and a height up to 6·3; the length of the posterior disk was 7·5 cm. by a breadth of 8·5 (the breadth of its brim 1·2); the length of the branchial slit 7 cm. by a breadth at both ends of 1; the height of the sipho 9 mm., that of the parapodia 13, of the (contracted) rhinophoria 6 mm.; the length of the curved gill in a straight line 3·5 cm. by a breadth of 2·3 and a thickness of 1·8 cm. The animal was one-coloured, yellowish white, the gill less bright.

The *shell* of typical form (figs. 12, 13), 4·3 cm. long by a breadth of 3·3; the crest on the hinder end not strong; the calcareous layer on the under side of the strong yellowish cuticula broken in pieces in front, the upper as well as the under side of the shell chalk-white.

The form of the animal was typical, the branchial fissure reaching to about the middle of the hinder disk. The back with rather numerous (fig. 11) small pointed cones of a height of 2–4 mm., as also the hinder disk, as well as its somewhat laciniated brim (fig. 10). The seminal furrow in its first part running in the depth between the parapodia for a length of 2 cm., then continued forwards to the male genital opening under the right tentacle. The mouth, the sipho, the anus, and the pallial gland as usual. Nearly the posterior half of the gill projects freely; on either side it showed about ten strong compound chief lamellæ; at the base of the frenulum of the gill the reno-branchial aperture. The common genital opening as usual.

The *central nervous system* agrees with that of the true Aplysiæ, and is quite different from that of the Notarchidæ, with which group the Dolabellæ otherwise show affinities; the visceral ganglia thus situated far backwards (on the side of the spermatotheca). The nearly coalescent cerebral ganglia measure in breadth nearly 4 mm.; the cerebro-pleuro-pedal connectives about 13 mm. long; the pleuro-pedal ganglionic mass 8 mm. broad; the pleural ganglia scarcely half as large as the pedal.*

* *Cf.* Amaudrut, Bull. Soc. Philom., x., 1886, pp. 68–74.

The very retracted and contracted mouth tube about 7 mm. long. The plump *bulbus pharyngeus* 15 mm. long and high by a breadth of 12, of usual form, with the end of the rasp-sheath somewhat prominent on the lower side posteriorly ; the strong inferior retractor muscles of the bulbus issuing from the region of the margin of the hinder disk of the body. The strong, somewhat brittle *mandible plates* of a length of 7 mm. by a breadth of 3·8 and a thickness of 0·4 mm. ; they were yellowish brown on the free side, on the breach yellowish white; their closely set angularly cylindrical elements of a diameter of 0·016 mm. (fig. 19). On each side of the *palate* a thin, dirty yellowish plate, 3 mm. broad, densely set with (fig. 18) horny, compressed hooks, of form as in other Aplysiidæ, of a length up to 0·8 mm. by a breadth to 0·10. This spinous covering continued a little behind the roof of the pharynx. The large *tongue* with deep cleft; the rasp brownish yellow, containing 42 se ies of plates (counted at the margin of the rasp), in the sheath 44, of which the 5 hindermost are not fully developed; the total number of series about 86; the 6 foremost on the tongue very incomplete and partly damaged. The number of plates in the series seemed to be about 200. The plates were yellow; the length of the median was about 0·20 by a breadth up to 0·07 mm. ; the height of the two outermost lateral plates was about 0·14–0·16 mm. ; through the series the height of these plates rose to 0·37 mm. The median plates in form very different from those of the proper Aplysiæ, longish, narrower in front, with a small denticulated hook at the anterior end (figs. 14, 15); the lateral plates of ordinary hook form (figs. 16–17).

The yellowish white *salivary glands* long, reaching to the cardia, nearly cylindrical, of a diameter of 2 mm., thinner behind ; the efferent duct quite short.

The length of the gray œsophagus with its dilatation (proventriculus) 4 cm. by a diameter of 7–12 mm., its interior with fine longitudinal folds and plump villi. The (masticatory) *stomach* brownish gray, somewhat roundish, of a (transverse) diameter of 2·5 cm. by a length and height of 1·7 ; the usual nerves run along this stomach, anastomosing at the pylorus and forming a circle around this, and then continued on the second stomach. The anterior part of this stomach had 8 somewhat depressed angular-roundish facets belonging to the stomach plates, and behind them 2–3 series of smaller and less regularly set facets. The 8 large very hard stomach plates were irregularly pyramidal; the broad basis convex, very smooth ; the height and the breadth nearly the same, 7–9 mm. ; the base and the top brown ; otherwise the base was chalk-white.

Behind these plates 10 somewhat smaller followed, mostly rather compressed, more irregular, yellow, of a height of 4–6 mm. Behind this stomach, in the mouth of the second, more thin-walled gray stomach, were seen about 5 series of rounded small papillæ, each with a pointed, straight, yellow prickle of the height of 2–2·5 mm. (fig. 20); papillæ of the same kind, mostly without horn, were scantily distributed over the stomach. The abundant content of the stomachs was fine paunce mixed up with vegetable substance (different algæ), parts of small worms, and some foraminifera and small Rissoa-like shells. The dirty gray *intestine* makes a large superficial curve in a furrow of the liver and ascends to the anus; its diameter 7–9 mm., its wall thin, its abundant contents the same as in the stomachs.

The large *liver* dirty and dark greenish gray, 5 cm. long by a breadth of 4 and a height of 3·8, superficially 3-lobed by the windings of the intestine; its mass compact, with a small cavity. In front, immediately behind the second stomach, opens the bent, horn-shaped *gall-bladder*, contrasting by its milk-white colour with the liver, of a diameter of 4 mm., with about its half freely projecting on the under side of the liver.

The bright yellowish white *kidney* 3·3 cm. long by a breadth of 2·3 cm. and a thickness of 5–6 mm.

The yellow-white *hermaphrodite gland* at the hinder end of the liver convex-plain, 4·5 cm. long by a breadth of 2·5, and a thickness of 2; in its lobules ripe genital elements. The thick hermaphrodite duct in corkscrew windings running to the anterior genital mass; its diameter mostly 3·5 mm., anteriorly much thinner. The *anterior genital mass* large, 3·5 cm. long by a height of 3 and a thickness of 1·5; chiefly formed by the large muco-albuminous gland. On the right side of this appeared a black central region of oval form, 11 mm. long, encircled by alternately more whitish and more yellowish arcuate windings; the left side more simple with a large winding. The curved *sperm-oviduct* extended 5 cm. long by diameter of 8–4 mm.; on the cuts two tubes, separated by an incomplete septum, appear. The *spermatotheca*, situated immediately before the pericardium, globular, of a diameter of 15 mm. The dark grayish *penis* (præputium) folded up extended 5 cm. long by diameter of 7–4 mm.; to its posterior end, which is yellowish, the strong retractor is attached, to its anterior end the digitations of the protractor. The inside with fine longitudinal folds and a thicker one, all with a number of black points. From the bottom of the cavity projects the flattened, blackish only at the point, else yellowish, somewhat strained *glans*, extended 15 mm. long by a

breadth of 5; one margin is thick, compact, otherwise it is flat, leaflike.

The colour of this specimen was different from those I also have seen *; the form of the shell, too, somewhat particular, and the stomach-plates different. Still, it is very likely but a variety of the somewhat variable *Dol. Rumphii* (Cuv., Rang).

NOTARCHIDÆ.

R. Bergh, Die Opisthobranchiata der Siboga Expedition, 1905, pp. 20–27.

This group contains the genera Notarchus (Cuv.), Aclesia (Rang), Aplysiella (P. Fischer), and Phyllaplysia (P. Fischer).

Aclesia, Rang.

Rang, Hist. Nat. des Aplysiens, 1828, p. 68, pl. xx.–xxii.

R. Bergh, Malacolog. Untersuch. V. 1900, pp. 352–361.—The Danish Expedition to Siam, 1902, pp. 168–174.—Die Opisthobranchiata der Siboga Expedition, 1905, pp. 20–23.

Notæum sicut rhinophoria et tentacula papillis majoribus simplicibus et cómpositis instructum; fissura branchialis brevis. Scutum palliale sicut testa desunt; branchia, ren et pericardium in cavitate branchiali libera (scuto non tecta). Podarium non angustum.

Ganglia visceralia antice, inter pleuralia sita. Penis conulis hamigeris armatus.

The genus was established by Rang, and the plates xx.–xxii. have the name of Aclesia; in the text he has (p. 68) retracted the name, referring the species named in the plates to the genus Notarchus of Cuvier, to which, however, they do not belong. The genus has mostly been adopted by malacologists and conchologists† for forms like those originally given by Rang, but a real knowledge of the genus dates from the later years (1900, 1902, 1905).

The Aclesiæ belong to the warmer seas, and especially to

* R. Bergh, "Die Opisthobranchiata der SibogaExpedition," 1905, pp. 13–20, taf. vii., figs. 22–40; taf. viii., figs. 1–9; taf. lx., figs. 1–3.

† The genus Thallepus of Swainson ("A Treatise of Malacology," 1840, pp. 250,359) is often mentioned as being synonymous with Aclesia. The characters given by Swainson are partly incorrect and quite insufficient; the characteristic tufts on the back of the Aclesiæ are not at all mentioned.

those of the tropics. Somewhat better known are the following species:

1. *Acl. Pleii*, Rang.
   M. atlant. occid.
2. *Acl. striata* (Q. et G.).
   M. africano-indic.
3. *Acl. cirrhifera* (Q. et G.).
   M. africano-indic.
4. *Acl. impexa*, B.
   M. phillipin.
5. *Acl. ocelligera*, B.
   M. Siamense.
6. *Acl. varicolor*, B.
   M. indicum.
7. *Acl. pusilla*, B.
   M. indicum.

ACL. CIRRHIFERA, Q. et G.

Aplysia cirrhifera, Q. et G. Voy. de l'*Astrolabe*, ii., 1832, p. 311, pl. 24, fig. 8.

Aclesia cirrhifera, Q. et G. Ed. v. Martens, Beitr. Meeresfauna d. Insel Mauritius u. d. Seychellen., 1880, p. 308.

Aclesia cirrhifera, (Q. et G.) Bgh., *l.c.*, 1900, pp. 351–360, taf. xxix., figs. 28–31.

Pl. III., figs. 16–24; Pl. IV., figs. 1–7.

Two individuals were procured from the lagoon at Port Alfred, five specimens caught at low-tide at Knysna along shore from jetty towards village, one was procured at the mouth of Nahoon on June 12, 1900, one more at East London in August, 1902.

They were all of a very similar exterior; but the colour of the smaller was dark greenish gray, that of the larger blackish gray, with small black dots; the foot always yellowish gray. The largest individuals were 8 cm. long, by a height and a breadth of 4; the height of the rhinophores and tentacles about 7 mm.; the length of the gill-slit 1–2 cm.; the breadth of the foot 3 cm.; the length of the tail 1·5–2 cm. The other individuals 5–7 cm. long.

The four specimens anatomically examined had a length of 4·6–7 cm. by a breadth of 2·6–4 and a height of 2·5–3; the height of the rhinophores and the tentacles 4–5 mm., of the papillæ of the back –5 mm.; the length of the gill-slit 6–10 mm.; the breadth of the foot 1·5–2·7 cm., the length of the tail 1–1·3 cm.—The animals were very soft in consistence.

The form of the animal as in other Aclesiæ, a little pointed behind, the back rather vaulted. The backside everywhere very uneven, covered with simple and compound papillæ, for very large part confluent to numerous undulating crests and tufts covered with smaller papillæ; on the sides of the back proper the crests sometimes coalesced in a kind of ridge and behind on each side over the tail in a larger prominent knot. The rhinophores and the tentacles also covered with papillæ. The border of the foot-wings convex, their inside even. The seminal furrow distinct. The foot a little broader in front, with a small median notch.

On the floor of the *gill-cavity* no mantle plate, and the organs were uncovered (Pl. III., fig. 16). On the left side the long white kidney with a pore on its hinder end (fig. 16). To the right of the kidney the strong curved gill, of dirty yellowish colour, with grayish or blackish rhachides (fig. 16). Stretched out, it had a length of about 2 cm. by a breadth and height of 4–5 mm., about its half not attached; it contained about 15–18 groups of lamellæ (fig. 1). Behind the first part of the gill the thick upwards turned anal papilla with black striæ and several (about eight) rather prominent knots around the opening (fig. 16*c*). Before the gill to the left the somewhat black dotted pericardium and to its left, under the brown part, the blood-gland; the vulva as usual.

The central nervous system as usual in the Notarchidæ.

The mouth tube 3–4 mm. long. The *bulbus pharyngeus* short-pyriform with the thick radula-sheath projecting a little on the lower side behind; 7·5–9 mm. long by a breadth of 5–6·5 and a height of 4·5–6, whitish. The mandibles longish, broader upwards, 2·5–3 mm. long by a breadth up to 0·75–1, dark red-brown (fig. 17); their elements nearly cylindrical, reaching to a height of 0·2 by diameter of 0·020 mm. (fig. 18). The walls of the cavity of the mouth dark red-yellow, darker on the palate, whose side parts showed the usual covering of closely set compressed hooks of a height up to 0·1 mm. (fig. 19); this covering is continued to some extent up into the pharynx. The rasp of the short and broad *tongue* (fig. 20) dark brown or brownish yellow, of a length and a breadth of 3–4 mm., containing 20–28 series of teeth, in the sheath 15–18, the total number of series thus being 35–46. The number of lateral plates on each side of the median about 36–40. The plates reddish brown at the basal parts, elsewhere yellow, the breadth between the legs of the median plates nearly 0·20; the lateral reached a height of 0·30 mm.; that of the four outermost was mostly about 0·12–0·16–0·20–0·24. The median plates of the usual form (fig. 21), with 3–4 denticles on each side of the pointed hook; the first lateral

plate (fig. 21) with bilobate hook and some small denticles on the margin of the outer lobe; on the following plates (figs. 3, 4) the outer lobe had become a coarse denticle; on the following one, two, or mostly three, rather blunt denticles on the hook (figs. 5, 6); sometimes the denticles failed on some plates, or four were seen (fig. 6); on the 3–5 outermost plates denticles were not seen (fig. 7).

The long white salivary glands, 12–14 mm. in length by a breadth of 0·5 mm., as usual, and reaching backwards to the masticatory stomach.

The œsophagus 8–10 mm. long, its hinder part sometimes dilated into a first stomach of a length of 4 by a breadth of 6 mm. The *masticatory stomach* 5–9 mm. long by a diameter of 9–10; it showed, arranged in the usual way, 8–10 larger pyramids, in the cardiac part moreover 6–4 smaller and more irregular, 8-7 more conical; or 10 larger and 8 smaller, in all 22–21–18 stomachal teeth. The larger were up to 4 mm. high and their base also to 4 mm. broad; they were brownish yellow, cartilaginous, translucent, and showed the common finely iridescent axial or subaxial column. The *third stomach* 8–12 long. The intestine as usual.—The *liver* dirty brownish yellow, 2·3–3 cm. long by a breadth of 1·5–1·6, reaches a height of 1·4–1·5; it was short-sausage shaped, by the windings of the intestine superficially divided in several longer or shorter lobes united with each other. Anteriorly beside the intestine a little biliary cavity was found, with several openings in the pyloric part of the third stomach; no proper biliary bladder was seen.

The pericardium was large. The ventricle of the heart 5 mm. long, the crista of the truncus aortæ pellucid, 2 mm. long.

The whitish small *hermaphrodite gland* 6–7 mm. broad by a length of 5–3 and a thickness of 2; in its lobes ripe genital elements; its duct in coils wound between the lobes of the liver to the inside of the *anterior genital mass* (fig. 2*a*). This latter whitish and yellowish white, in length measuring 10–15 mm. to the vulva by a height of 5–6 and a thickness of 2–3 mm. The proper (fig. 2*b*) muco-albuminous gland convex-plain, on its upper margin the pellucid pear-formed *spermatocysta* of a length of 3 mm. (fig. 2*c*), opening with its duct in the root of the sperm-oviduct. The gland is continued in a nearly cylindric tube, a little longer than the gland itself, the *sperm-oviduct* (fig. 2*d*), on sections it is seen divided into two parts of unequal size by a strong fold or partition-wall; in the lower part the *spermatotheca* seems to open. This latter (fig. 2*e*) lies before the heart, on the hinder end of the stomach; it was globular, yellowish, of a diameter of 4 mm.; its duct a little longer

than the bladder itself, opening near the vulva (fig. 2*f*).—The *penis* 7–10 mm. long by diameter of 1·5–2, nearly cylindrical, a little tapering anteriorly (fig. 22); its anterior half blackish, the rest yellowish; the inside is also dotted with black and shows fine longitudinal folds, between which one stronger than the others and continued up to and on to the small, 2 mm. long, whitish conical glans. This last and the top of the præputium show small cones partly set in longitudinal series (fig. 23); most of the cones carry a horny thorn, a little curved and of a height up to 0·28 mm. (fig. 24).

The form here examined probably represents a variety of the typical *Acl. cirrhifera.*

CEPHALASPIDEA.

PHILINIDÆ.

Philine, Ascanius.

Philine, Ascanius. Vetensk. Ak. Handl., 1772, p. 329.
Lobaria, O. Fr. Muller. Zool. Dan. Prodr., 1776, pp. xxix., 226. —Zool. Dan., iii., 1788, pp. 30–31, tab. C, figs. 1–5.
Bullæa, Lam. Systém des An., s. v. 1801, p. 63.
Philine, Asc. Bergh, Malacol. Unters. v. 1900, p. 275.—Die Opisthobranchiata der Siboga Exped., 1905, pp. 28–32.

Animal sat applanatum (testa non recondendum); clypeus frontalis magnus, subquadratus, postice non lobatus, oculis externe conspicuis nullis; sub margine laterali clypei antice rhinophoria parva plicata; osphradium parvum simplex ante fissuram branchialem situm. Pallium testam omnino includens, postice paullum supra et infra prominens; glandula spiralis nulla. Podarium breve, latum, epipodiis sat crassis lateribus interstitium inter pallium et clypeum implentibus.

Testa interna tenuis, fragilis, pellucida, alba, sat applanata; spira minuta depressa; apertura amplissima, postice angustior; columella angusta callo levi.

Mandibulæ nullæ. Radula rhachide nuda, pleuræ dente laterali fortissimo uncinato et interdum dentibus externis (1–6) hamatis.—Glandulas salivales parvæ sacciformes. Ventriculus masticatorius (fere semper) laminis calcareis fortissimis subsimilibus oblongis tribus armatus, utrinque laterali et inferiore singula.

Penis inermis, apparatu prostatico fortissimo præditus.

These animals are of very peculiar form; their thin shell quite

inclosed in the mantle. They have no mandibles. The rhachis of the tongue is naked; the pleuræ wear a very strong, particularly formed lateral plate and sometimes also (1–6) outer plates. They have a particular masticatory stomach with three very strong calcified plates. Their unarmed, peculiarly formed penis is provided with a well-developed prostatic apparatus.

1. Philine aperta (L.).

Bulla aperta, L., Syst. Nat., ed. xii., 1767, p. 1183; ed. xiii. (Gmelin), t. i., pars vi., 1791, p. 3424.

Philine quadripartita, Asc. *l.c.*, 1772, p. 329, tab. x., figs. *a*, *b*.

Bulla Schroeteri, Phil. En. moll. Sic., ii., 1844, p. 94, tab. xx., fig. 2.

Bulla Schroeteri, Ph. Krauss, Die südafrikan. Moll., 1878, p. 70.

Philine quadripartita, (Asc.) R. Bergh. Malac. Unters. v. 1900, pp. 276–285, taf. xxiii., figs. 15–35; taf. xxiv., figs. 2–5; taf. xxvi., figs. 1–9.

Pl. V., figs. 5–10.

More than twenty large specimens were procured by dredge off Elsie Peak (False Bay) from a depth of 10 fms. on sand and shell bottom; several also near Roman Rock (False Bay) by shrimp-trawl on fine sand from a depth of 13–18 fms., and in False Bay, and off Cape Natal and Umvote River.

The first-mentioned had a length of 5·5–6 cm. by a breadth of 3·5–3·3 and 4, and a height of 1–1·5 and 2 cm.; the length of the piece behind the foot was 1·8–2 cm. The animals were coloured white.

The *shell* was 2·8 cm. long by a breadth of 2·5, and a height of 1·5 cm.; white, rather solid.

The form of the animal quite as usual. The tentacular (frontal) shield and the mantle shield nearly of the same length. The flat rounded-hexagonal *tentacular shield* with its slightly prominent margin mostly covering the neck, and sometimes also the anterior margin of the mantle shield. The anterior margin a little notched in the middle, and on each side of it a fine pore; next to the furrow between the shield and the foot the yellowish, slightly prominent *rhinophore* about 1 cm. long, with about fifteen low folds. The *mantle shield* somewhat convex, rather posteriorly and somewhat to the left sometimes (in the two larger individuals and three smaller), a fine opening leading to the shell. The hinder margin of the mantle prominent beyond the shell, notched medianly, and passing in the rather flat and broad covering of the left part of the shell and

of its free margin. This under part of the mantle is separated from the foot by a rather deep furrow, and towards the right side cleft by the open longitudinal branchial fissure; behind the hinder end of the fissure a fine glandular opening. The *branchial cavity*, in accordance with the form of the shell, rather low; the curved, brownish *gill* about 10–12 mm. long by a height of 4–6 and a breadth of 3–5. Over the gill the small, sometimes black punctuated, *osphradium;* above the root of the gill the prominent *anus*. Below the fore end of the gill the *vulva*, whose opening is continued in the seminal groove that runs along the low side of the body to the male aperture near the mouth. The broad *foot* a little narrower before, with a little median notch or slit, on each side of which there is a fine opening; the sides of the foot through their whole length developed into a strong wing, on the sides filling the space between the two shields, thicker below, rising to a thin convex margin; the posterior margin free, covering the groove before the under side of the mantle, oblique from the right side to the left and forwards, straight or convex in the middle, with posteriorly prominent edges belonging to the wings of the foot.

The length of the whitish mouth tube 6–7 mm., its inside yellowish. The whitish *bulbus pharyngeus* of the usual form, 5–6 mm. long. The strong tongue, with deep cleft, with yellowish or brownish yellow rasp, containing 15–20 series of plates, in the sheath 12–16, of which the two hindermost are not fully developed; the total number of series being thus 27–36. The rhachis not narrow. The plates nearly colourless in their upper half; their length (in straight line) 1 mm.; their form was quite as formerly described (*l.c.*, p. 279); still, the denticulation was finer than in the specimens from the Atlantic and Mediterranean Sea, and did not seem to extend so far out on the hook as in these specimens (figs. 6–8).

The *salivary glands* small but somewhat longer than usual, 4–6 mm. long, whitish, applanated (fig. 5).

The œsophagus short, 3 mm. long. The first *stomach* 6 mm. long by a diameter of 6–7, its hinder end sunk in the cardia of the second stomach. This *masticatory stomach* sometimes turned a little to the right, usually lying on the under plate, 2 cm. long by a breadth of 1·3 and a height of 1·2. The two lateral masticatory plates 20 mm. long by a breadth of 7·5–8 and a thickness of 2–3; the inferior of a length of 16 by a breadth of 9 and a thickness of 3 mm.; their outside yellowish or chalk-white; the inside showed the large flat central part white; this part was inclosed by a broad belt of fine yellow lines, the marginal part white; the two small holes on the

outside and inside less pronounced than in the specimens from other localities, and even on the inside scarcely visible; still, one or two of the three plates showed in two individuals three holes. The *third stomach* 10–11 mm. long by a diameter of 4–5, with very thin walls with fine folds. The *intestine* as usual, about 10 cm. long by a diameter of 2–4 mm.—The contents of the stomachs (sometimes, too, of the bulbus pharyngeus) chiefly very fine sand-particles, thin pieces of algæ, fragments of small bivalves, some Polythalmia.

The *liver* dirty brown, 2–2·5 cm. long by a breadth of 1·2–1·4 and a height of 1 cm.

The white *kidney* 13 mm. long by a breadth of 3–4.

The yellow *hermaphrodite gland* covering the hinder end and a small part of the upper side of the liver with a layer about 4 mm. thick; the ampulla of its duct forming a coil of white windings. The *anterior genital mass* seemed to be essentially quite as before (*l.c.*, p. 283) described, 12–14 mm. long. The grayish brown spermatotheca globular, of a diameter of 6 mm.; the strong yellowish duct 8 mm. long; the spermatocyst whitish, sack-formed, 2 mm. long. The seminal furrow terminating in the male aperture near the right side of the mouth. Into it also opens the *penis*, which is pear-formed, 4·5–5 mm. long; on the base of the organ is fixed a strong retractor, and into its cavity opens the large prostata, a small globular gland, and a small cylindrical sack of the length of 2 mm. (fig. 9*c*). The large coil of the *prostata*, 8–11 mm. long by a breadth of 8–9, lying under and behind the bulbus pharyngeus; when disentangled the length of the organ was about 20–25 cm.; the tube was yellowish, its last windings white. The small, mostly *globular*, glandular *sack* (fig. 9*e*) yellowish, 2–2·5 mm. long, its duct mostly 2–3 times as long; the sack was always intimately fixed to one of the windings of the prostata (fig. 9*a*). From the base of (fig. 9*d*) the penis sack (præputium) projects the glans, nearly as long as the sack, mostly very pronounced hammer-shaped (fig. 9*e*), along the stalk a distinctly visible furrow, issuing from the opening of the (fig. 10*a*) prostata and continued especially along one of the legs of the hammer; in one of the individuals the end of the hammer projected from the genital opening (fig. 9).

In spite of some differences, this form seems to belong to the typical *Ph. aperta*. According to Hanley * the original specimen of Linnæus was from the Cape, and there seems to be every reason for returning to the old specific name.

* Hanley, *ipsa Linnæi conchylia*, 1855, pp. 203–204.

2. Philine capensis, Bgh. n. sp.

Pl. V., figs. 11–15.

Off Cape Point Lighthouse, SW. by W. 4½ miles, one specimen was taken by shrimp-trawl from a depth of 29 fms. on bottom of fine sand.

It was of whitish-yellow colour. Its length was 11 by a breadth of 7 and a height of 6 mm.; the frontal shield very inclined forwards, 6 mm. long; the mantle shield 9 mm. long by a breadth of 5; the wings of the foot 2·5 high.

The thin mantle quite enveloping the shell except (by mutilation of?) the middle. The *shell* as long and large as the mantle, chalk-white, not thin, but rather fragile, of usual (fig. 11) form.

The *bulbus pharyngeus* 1 mm. long, with prominent rasp-sheath, the lip disk with strong cuticula. In the yellow rasp of the *tongue* 8 series of rows, in the sheath 14, the total number of rows being therefore 22; the radula formula was 2–1–0–1–2. The nearly colourless lateral plates (fig. 12) of about the usual form, (in direct line) measuring in length 0·30; the first external plate rather thin, about 0·20 mm. long (fig. 13); the other, the outermost, shorter and a little thicker, 0·14 mm. high (fig. 14).

The whitish salivary glands long, strong, very nodular.

The *masticatory stomach* 3·5 mm. long by a diameter of 3; of its plates, the median a little smaller than the others, which measured 2·5 mm. in length by a breadth of 1 (fig. 15); they were greenish yellow, rather thin and flexible; no holes could be detected either on the outer or on the inner side.

The large liver, sausage-formed, 7 mm. long, 4 broad, gray on the outside, its substance brown-gray.

The penis and the very large bundle of coils of the prostata seemed to agree with the arrangement in the typical species.

This form belongs to the group of Philine, which has outer as well as lateral plates—one (*Ph. scabra*, M.; *Ph. catena*, Mtg.; *Ph. Lovéni*, Malm; *Ph. sinuata*, Stimps), or two (*Ph. quadrata*, Wood; *Ph. lima*, Brown; *Ph. velutinoides*, Sars), or several (6) (*Ph. pruinosa*, Clark).*

* *Cf.* Sars, Moll. reg. arcticæ Norvegiæ, 1878, pp. 293–303, tab. 18, xii.

DORIDIIDÆ.

R. Bergh, Die Gruppe der Doridiiden. Mittheil. aus der zool. Station zu Neapel, xi., 1893, pp. 107–135, taf. 8.—Die Opisthobranchien. Report on—*Albatross*, xiii., 1894, pp. 205–222, taf. x.–xii.—Malacol. Unters. v. 1901, pp. 177–181, 303–307, taf. xxv.

Eliot, On Doridiidæ. Proc. Malacolog. Soc., v., 1903, pp. 331–337, pl. xiii.

R. Bergh, Die Opisthobranchiata der Siboga Expedition, 1905, pp. 42–46.

This group of rather pregnant exterior contains two not very different genera.

I. Doridium, Meckel.

R. Bergh, *l.c.*, 1893, p. 109.—1894, p. 209.

1. *Dorid. tricoloratum* (Renier).
   M. Mediterr.
2. *D. depictum* (Renier).
   M. mediterr.?
3. *D. punctilucens*, B.
   M. Antillense.
4. *D. purpureum*, B.
   M. pacific.
5. *D. cylindricum* (Cheeseman).
   M. pacific.
6. *D. ocelligerum*, B.
   M. pacific.
7. *D. diomedeum*, B.
   M. pacific.
8. *D. lineolatum*, (H. & A. Adams) B.*
   M. pacific.
9. *D. cyaneum*, v. Martens.
   M. africano-indic.
10. *D. pilsbryi*, Eliot.
    M. pacific.
11. *D. capense*, B.
    M. pacific.

* R. Bergh, Gaster. opisthobranchiata, 1902. The Dan. Exped. to Siam, pp. 17–18, pl. ii., fig. 12.

12. *D. obscurum*, B.
M. pacific.
13. *D. albo-ventrale*, B.
M. pacific.
14. *D. Gardineri*, Eliot.
M. pacific.
15. *D. reticulatum*, Eliot.
M. africano-indic.

II. Chelidonura, A. Adams.

Chelidonura, Ad. R. Bergh, Die Opisthobranchier (Schauinsland, Ergebn. einer Reise). Zool. Jahrb., xiii., 1900, pp. 212–220. —R. Bergh, *l.c.*, 1905, pp. 42–46.

? Navarchus, Cooper. R. Bergh, *l.c.* (*Albatross*), 1894, pp. 213–222.

1. *Chelid. hirundinina* (Q. & G.), var. *elegans*, B.
,, ,, (Q. & G.), var. *punctata*, Eliot.
M. pacific et africano-indic.
2. *Ch. inermis* (Cooper).
M. pacific. (Calif.).
3. *Ch. œnigmatica* (B.).
M. pacific. (Panama).
4. *Ch. plebeia*, B.
M. pacific.
5. *Ch. varians*, Eliot.
M. africano-indic.
6. *Ch. velutina*, B. (Siboga-Exped., 1905).
M. indic.
7. *Ch. philinopsis*, Eliot.
M. africano-indic.
8. *Ch. amœna*, B. (1905).
M. indic.

Doridium capense, B. n. sp.

One individual was captured on the shore at East London (23.5.02). Preserved in formalin it still had the largest part of a 2·5 cm. long Annelide hanging out of the retracted mouth.

It measured to the end of the hinder wings 5 cm. in length by a breadth (with raised foot-lobes) of 1·8 and a height of 1·9; the length of the anterior shield was 2·2 cm., its hinder end projected freely 6 mm.; the wings of the hinder shield 10 mm. long; the proper foot 13 mm. broad, its wings 8 mm. high, the tail 8 mm. long. The animal was nearly uniformly coloured grayish white (but had

certainly been darker when alive); the under side of the free part of the anterior shield, the neck under it and the sides of the body blackish, the margins of the foot-lobes on the hinder wings blackish on their inside (fainter on their outside); the large gill white; the foot grayish, black at its anterior end.

The form as usual; the fore shield rather long; the wing-like lobes of the hinder shield projecting downwards with the point turned somewhat inwards; the right wing seemed somewhat larger than the left; no flagellum. The whole of the upper side of the animal quite smooth. The large gill projects nearly quite free from the gill cavity; it is 8 mm. broad by a height of 6 mm., composed of 10 large tufts of lamellæ, its end a little rolled up.

The *shell* quite membranous with a faint touch of yellowish, only the indistinct rolled up small nuclear part a little calcified; the large winding did not seem to project towards the root of the right wing; the length of the shell 13 by a breadth of 7 mm.

The mouth tube 6 mm. long, black on the outside as well as on the inside. The *bulbus pharyngeus* 14 mm. long by a height of 9 and a breadth of 8 mm., yellowish white on the outside and the inside, of the usual rounded prismatic form and of the usual structure; the walls of the arrow-formed cavity of a thickness of 2·5–3 mm.

The liver yellowish gray.

The penis yellowish, black in front.

This form is perhaps specifically different from the other hitherto described.

NOTASPIDEA.

PLEUROBRANCHIDÆ.

R. Bergh, Malacolog. Unters. v. 1897–98, pp. 1–158, 371–380, taf. i.–xii.

PLEUROBRANCHÆA, Leue.

R. Bergh, System, *l.c.*, p. 4 (-51).—*l.c.*, II., 1905, pp. 47–49.

1. Pleurobranchæa capensis, Vayss.

Vayssière, Monogr. de la Fam. des Pleurobranchidés, 2 partie. Ann. des sc. nat., 8 S., t. xii., 1901, pp. 46–49, pl. iv. figs. 232–237.

Pl. IV., figs. 8–11.

A notice of the locality, where 19 individuals of this form had

been caught, is wanting; at Cape Point Lighthouse by shrimp-trawl on fine sand-bottom from a depth of 33 fms. 8 more were taken.

They were very similar in size and colour, and were in a very contracted condition in the formalin in which they were preserved; 4 individuals were dissected.

The length of the largest was 2·3–3·5 cm. by a breadth of 2–2·3 and a height of 1·5–2; the gill 10–16 mm. long by a breadth of 4–6; the foot 15–16 mm. broad. The colour whitish or grayish whitish, the back with a faint olive-gray network of lines and patches partly bordering, partly covering the not very pronounced nodules. In nearly all individuals the black œsophagus was very distinctly visible through the surrounding tissues.

The back covered all over with weak nodules. The rather flattened gill with about 15–17 tufts of lamellæ on each side of the rhachis. The præbranchial papilla very distinct, somewhat cleft. A tail-gland not externally visible and a finger on the end of the tail always absent.

The mouth tube 4 mm. long, its inside blackish gray. The *bulbus pharyngeus* whitish, together with the prominent rasp-sheath 7·5–8–10 mm. long by a breadth of 5–6 and a height of 4–4·5 mm. The mandibular plates rather hard, grayish yellow; their elements (figs. 8, 9) as usual high, a little curved, columns of a height up to 0·29 mm. by a diameter of 0·04. The palate, which was longitudinally and transversely wrinkled, was black, as were also the cheeks. Th rasp of the *tongue* brownish yellow, containing 26–30–34 rows of plates, in the sheath 18–20–25, the total number of series being thus 44–50–59. The number of plates in the rows seemed to amount to 95. The plates pale yellow in the basal part, otherwise colourless; the height of the outermost about 0·08 mm., that of the largest 0·4. On the narrow rhachis a fine longitudinal fold, sometimes broken in pieces, but no trace of false plates. The plates (figs. 10, 11) essentially as in the *Pl. Meckelii*, the outermost 4–8 without denticle.

The ampulla of the duct of the glandula salivalis white or blackish, but the continuation of the duct towards the mouth black. The gl. ptyalina well developed, its tubes often covering the back of the bulbus pharyngeus.

The œsophagus black, on the inside velvet-black, 4·5–5 mm. long, in the hinder part of a diameter of 3. The liver 12–16 mm. long by a height and a breadth of 9–10, dirty-yellowish, or grayish, on sections brownish.

The *anterior genital mass* yellowish white, 8–10 mm. long by a height of 4·5–7 and a breadth of 4–7; the prostata short-reniform, its greatest diameter being 5 mm.; the vas deferens as in the species

described by Vayssière, much shorter than in the typical species (cf. *l.c.*, p. 49, fig. 232).

Perhaps the form here examined is really the *Pl. capensis* of Vayssière.

PLEUROBRANCHÆA CAPENSIS, Vayssière, var.

Pl. XI., figs. 1–8.

One specimen was found off Cape Hangklip; in its mouth an annelide, 11 mm. long, was sticking. The state of preservation was not good.

It was uniformly coloured whitish. Its length about 18 mm. by a breadth of 10 and a height of 6; the breadth of the frontal veil (with the 3 mm. long tentacles) 10 mm.; the height of the rhinophoria 2·5; the gill 5 mm. long by a breadth of 3; the penis projected 2·5, the præbranchial papilla 0·8 mm.; the breadth of the foot 10 mm., the tail 3 mm. long.

The form as usual. On the margin of the frontal veil very slight traces of papillæ; the back quite even. On the somewhat prominent genital papilla were situated the rather projecting penis in front and the female opening behind; between the genital papilla and the gill the prominent præbranchial papilla. The gill with about 20 leaves on each side, its hindmost part (2 mm. long) free; at the base of this part the anal papilla; under the middle of the gill the fine renal aperture. The tail without finger-like papilla; its gland not pronounced, about 2 mm. long.

The intestines were not visible through the walls of the body.

The central nervous system as in other Pleurobranchææ. The large eye of a diameter of 0·28 mm.

The mouth tube 2 mm. long, wide. The *bulbus pharyngeus* whitish, but its inside and the palate black; the length 6 by a breadth of 4·5, and a height of 3 mm.; the rasp-sheath 1·5 mm. projecting. The mandibular plates longish, 3 mm. long, clear yellow; their elements as in other Pleurobranchææ, of a height up to 0·20 mm. by diameter of 0·045; they were mostly hexagonal, the free facet in the anterior margin finely denticulated, the number of the denticles commonly 8–10 (figs. 1–2). The broad *tongue* with very pale yellowish radula with about 25 series of plates, in the sheath 20, the number of series being thus 45; the number of plates on each side amounted to 50. The plates (figs. 3–6) colourless, of the usual form, the length of the largest 0·30, their height 0·20 mm.; the length of the outermost (fig. 6) 0·10 mm., the denticle of these last sometimes very short.

The proper *glandula salivalis* white, transversely ovate, 1·5 mm.

broad, the two long efferent ducts in their last, about 2 mm. long, portion gray, as were also their pear-formed ampulla. The gl. ptyalina and its duct as in the typical species.

The *œsophagus* violet-black. The *liver* grayish yellow, 9 mm. long by a breadth of 7.

The præbranchial sack (fig. 7) rather bent, extended nearly 6 mm. in length.

The *hermaphrodite gland* whitish, about 5 mm. broad by a thickness of 2. The *anterior genital mass* whitish, 5 mm. long by a height and breadth of 3; the prostata of a diameter of 2·5 mm.; the coils of the continuation of the vas deferens extended 3 cm. in length, much longer than represented by Vayssière (*l.c.*, p. 49; pl. 4, fig. 232*cd*), but absolutely different from the relations of the organ in *Pl. Meckelii**; the internal sheath of the vas deferens projecting (fig. 8) 1·2 mm. (0·05 mm. broad) from the end of the penis.

The forms here examined differ from the typical one by the absence of the caudal finger and the very different relations of the vas deferens. It may be that it is really the *Pl. capensis* of Vayssière; the individuals which have been examined by Vayssière as well as by me, have been too insufficient to settle the question with certainty.

2. Pleurobranchæa melanopus, B. n. sp.

Pl. IV., figs. 12–15.

Off Cape Point (NE. by E. 36 miles) one individual was caught by shrimp-trawl from a depth of 650 fms.; the bottom was green mud.

The length was 2·4 by a breadth of 1·5, and a height of 1·3 cm.; the height of the rhinophores 4, of the tentacles 3 mm.; the length of the gill 5 mm. by a breadth of 2·5; the breadth of the foot 8 mm., the length of the caudal gland 3 mm. by a breadth of 1.— The animal very likely had been velvet-black all over, but on the back this colour only remained on the head and partly towards the margin; elsewhere it seemed rubbed off; the dirty yellowish colour of the gill, with traces of black on the rhachides, of the cleft præbranchial organ, and of the outer genitals as well as of the caudal gland, contrasted with the black of their surroundings.

The anterior margin of the tentacular veil with 2–3 series of small nodules. The back quite even. The gill somewhat flattened, with

* *Cf.* my Monogr. of the Pleurobranchidæ (*l.c.*, v. 1897, p. 25–26; taf. iii., fig. 22; taf. iv., figs. 3*b*, 4*c*, 5*b*.

about 20 lamellæ on each side of the smooth rhachis. No caudal finger.

The inside of the mouth tube black. The whitish *bulbus pharyngeus* 7 mm. long by a breadth of 6 and a height of 5; the pharynx black, as also were the walls of the mouth-cavity. The mandibles under the black coating wax-white; their somewhat compressed elements of the usual form (figs. 12, 13) 0·20 mm. high, their upper facet of a length of 0·06. The rasp of the *tongue*, dirty-brown, seemed to contain about 22 rows of plates, in the sheath 17, the total number of rows being thus 39; in the series on each side of the narrow rhachis very likely about 60 plates. The basal part of the plates reddish brown, their height reaching to about 0·4 mm., that of the two outermost 0·14 and 0·16; their form (figs. 14, 15) the usual, the outermost mostly without the denticle.

The whitish, roundish, flattened gl. salivalis of 5 mm. diameter; the gl. ptyalina very developed.

The brownish gray liver 13 mm. long by a height of 7. The large whitish kidney 12 mm. long by a height of 7 and a thickness of 2, with many transverse furrows.

The yellowish *hermaphrodite gland* lying on the hinder end of the liver and the kidney, and continued along the upper margin of the latter; in the male and female lobules ripe genital elements. The anterior genital mass somewhat compressed, 10 mm. long, and, as far as could be determined, as in the typical species.

OSCANIOPSIS, Bgh.

R. Bergh, Die Pleurobranchiden, 1, 1897, p. 53. (Malacolog. Unters. V., p. 53 (–61).)

Vayssière, Monogr. de la Fam. des Pleurobranchidés, ii. Ann. des sc. nat. Zool., 8 S., xii., 1901, pp. 6–15.

R. Bergh, Die Opisthobranchiata der Siboga Exped., 1905, pp. 49–52.

Caput discretum nullum. Notaeum a velo (scuto) frontali (tentaculari) latissimo non discretum, applanatum, læve, testa nulla; tentacula sicut rhinophoria distantia, lateralia, canaliculata. Rhachis branchiæ serie nodulorum duplici instructa. Apertura genitalis simplex. Podarium magnum, infra massa glandulari caudali mediana præditum.

Connectiva cerebro- et pleuro-pedalia brevia sed distincta.—Mandibulæ ex elementis applanatis compositæ.

This group represents a passage from the Pleurobranchææ to the

Oscanii. The back is, as in the former, continued directly into the large semilunar tentacular shield; the tentacles as well as the rhinophores are thus very distant; no shell in the flat and even back. Oscaniopsis has the short form of Oscanius, and the rhachis of the branchia shows as in the last a double series of nodules. They have, moreover, a simple genital aperture, and the large foot shows on the under side of the tail a peculiar gland. The central nervous system and the elements of the mandibular plates are as in the Oscanius. Sometimes the glans penis is covered with small cones.

On the form of the tentacular shield in the *Pleurobranchus luniceps* H. and A. Adams (in 1858) established the genus *Neda;* this was adopted by Gray (Guide, 1, 1857, p. 203) as well as (still with some doubt) by P. Fischer (Man. de Conchyl., 1887, p. 573). The genus *Oscaniopsis* was formed and scientifically established much later. There is hardly any real reason for returning to the loosely sketched denomination Neda.

The genus has contained hitherto merely some few forms from the Chinese and Indian Sea (*Osc. Semperi*, B.; *O. compta*, B.; *O. Amboinei*, Vayss.*), which perhaps are not even specifically different, but identical with *O. luniceps* (Cuv.), which has been known for a long time.

Oscaniopsis pleurobranchæana, B.

Pl. IV., figs. 16–21.

One specimen was obtained off south head of Tugela River by shrimp-trawl from a muddy bottom at a depth of 12–14 fms.

It had a length of the body of 3·5 cm. by a breadth of 1·8 and a height of 1·2; the breadth of the tentacular shield was 2·2 cm., the height of the rhinophores 6 mm.; the breadth of the brim of the back was, on the right side and over the tail, 8 mm.; on the left side the brim was narrower; the gill 15 mm. long by a breadth and height of 5; the length of the foot 3·5 cm. by a breadth at the anterior end of 1·5, the length of the tail 1·2 cm.—The animal was *coloured* white; through the foot and the side the intestines appeared brownish gray.

The large semilunar tentacle shield gives the animal a very peculiar appearance. This shield is, in the middle of the margin, rather broadly notched; it ends in tentacles in the usual way; the

* Vayssière, "Monogr. de la Fam. der Pleurobranchidés," 1, 1898, pl. 15, fig. 27 (*Pleurobranchæa maculata*, Q. et G.); ii., 1. *l.c.*, 1901, pp. 15–20, i. pl. 1, figs. 190–204.

margin with about 20 small prominences, of which 3–4 on each si e have a knotted appearance (fig. 16). The shield as well as the whole of the back are otherwise rather flat, quite even. The distance between the base of the rhinophores 1 cm.; the brim of the back rather projecting over the tail, rounded behind. The præbranchial papilla strong, not cleft; before it the prominent vulva. The gill rather pointed behind, its half freely projecting, the number of lamellæ about 40, the vesicles at their base small; the renal and the anal pore as usual. The foot rounded in front with a fine marginal furrow, its brim rather broad (5 mm.); the tail rather long, on the outside scarcely any trace of a gland visible.

Half of the *bulbus pharyngeus* projected freely in front. The bulbus of a length of 14 by a breadth of 10 and a height of 9·5 mm. of the usual form. The mandibular plates whitish, thin and very brittle; their elements reaching a length of 0·06 mm. by a height of 0·025, of the usual form, the denticulation very slight (fig. 17) or wanting. The palate of the mouth-cavity black. The *tongue* with yellow rasp, which seemed to contain about 40 series of plates; the number of the series in the sheath could not be determined on account of the hardened and brittle state of the whole of the tongue and especially of the sheath. The number of plates in the series could not be determined, but exceeded 100. The lower part of the plates brownish yellow, the rest nearly colourless; their height was up to 0·63 (measured from the anterior end to the point), the length of the innermost 0·58, of the three outermost 0·10–0·16–0·25 mm. The plates were different from those of other known Oscaniopsis, nearly quite as in the Pleurobranchæa, provided with a long pointed denticle (figs. 18, 19), only the 4 outermost had no such denticle (fig. 20).

The central nervous system as usual; the cells reaching a diameter of 0·2 mm. The eyes of a diameter of 0·30 mm., with large yellow lens.

The white salivary glands (gl. salivales) roundish (fig. 21), button-like, with deep hilus, one touching the other in the midline; together they measured 4·5 mm. in diameter, the white ducts with the usual ampulla at some distance from their end. The supplementary salivary gland (gl. ptyalina) very developed, its duct whitish.

The black œsophagus 6 mm. long by a diameter of 2–4; the inside also black, with fine longitudinal folds.

The grayish stomach 7 mm. long by a diameter of 4. The intestine as usual. The contents of the stomach and of the intestine were indeterminable animal matter.

The *liver* brown, 10 mm. long by a breadth of 4 and a height of 6;

on the right side partly covered by the kidney, on the upper side and on the posterior end partly by the hermaphrodite gland, in front by the gland. salivales.

The kidney whitish gray, 7 mm. long by a breadth of 6.

The *hermaphrodite gland* white, 9 mm. long by a breadth of 3 and a thickness of 1·4; in the predominant male follicles bundles of zoosperms, in the female less developed eggs. The white somewhat globular *anterior genital mass* of a maximum diameter of 2·25 mm. The hermaphrodite duct long, thin, forming many windings; on the mass in front the sperm duct makes a clew of windings; the prostata somewhat applanated, roundish; the præputium of the penis thin; no cones were detected on the glans.

This is certainly specifically different from the typical form, and constitutes a connecting link between Oscaniopsis and Pleurobranchæa.

Oscaniella, Bgh.

R. Bergh, Die Pleurobranchiden, *l.c.*, v., 3, 1898, p. 94 (–115).—Die Opisthobranchiaten der Siboga Expedition, 1905, pp. 58–66.

The Oscaniellæ are intermediate between the genera Oscanius and Pleurobranchus.

They belong to the warmer regions of the seas, especially to the Indian and Pacific Ocean.

Oscaniella nigropunctata, Bgh. n. sp.

Pl. IV., figs. 22–26; Pl. XI., figs. 9–18.

One specimen was procured off Cape Infanta by tow-net. It was rather contracted and bent together.

In its present state the *length* is only 22 mm. by a breadth of 16 and a height of 12. Examined more closely the breadth of the brim of the back was 6–8 mm.; the length of the rhinophores 5, of the tentacles 3 mm.; the length of the gill 8 mm. by a breadth in front of 4; the breadth of the foot 14 mm., of its brim 5; the length of the tail 9 and of its gland about 4 mm.—The general colour of the animal was yellowish; the back covered all over with somewhat darker scarcely prominent, sometimes nearly confluent, roundish or polygonal areas of a diameter up to 3·5 mm.; on the anterior and posterior ends of the back, as well as towards its sides and especially on the brim, the areas show a very pronounced black centre (fig. 9). On the under side of the brim the dark areas shone distinctly through. Black spots were scattered over the brim of the foot as well as on the tail. The intestines shone through the skin nowhere.

Quite in front a small, perfectly transparent, colourless *shell*, 2·5 mm. long, and without any trace of calcification, was seen (fig. 10).

The form was as usual; the tentacles small; the back smooth with brim broad; the gill with two very pronounced series of nodules (vesicles); in front of the gill a small præbranchial tube. The genital apertures without protecting folds. The foot well developed, the tail projecting behind the body proper.

The central nervous system quite as in other Oscaniellæ. The ganglion opticum distinct with a short N. opticus, the diam. of the large eyes 0·30 mm.; in the skin of the back, as is usual in the Oscaniellæ, there were peculiar filaments (fig. 11) of different length and bent in the most different way, often serpentine; their diameter 0·0035–0·005.

The length of the buccal tube 3 mm.; that of the *bulbus pharyngeus* 4·5 mm. by a breadth of 5 and a height of 3·5; of the usual form, the rasp-sheath a little projecting behind. The yellowish mandibles quite as usual, as also their rather clumsy elements (figs. 12–14), whose length rose to 0·22 by a breadth of 0·14 and a height of 0·08 mm.; on each side of the somewhat pointed hook 2–4 short denticles. The *tongue* as usual; in the yellowish rasp about 25 series of plates, in the sheath 20, the total number of rows being thus 45; in the series up to about 120 plates. The plates (figs. 15–18) were yellowish; the height of the innermost 0·035 mm., rising to 0·12, further on up to 0·18, then decreasing, the tenth from the outer margin of the rasp measuring 0·08, the outermost 0·035 mm. The plates of the inner half of the series hook-formed (figs. 15, 16), those of the outer erect with shorter base (figs. 17, 18); the teeth had no trace of denticles.

The stomachs as in other Oscaniellæ. The liver yellowish brown.

This form seems different from the other hitherto known species.

Oscaniella nigropunctata, B. var.?

Pl. IV., figs. 22–26.

Off Cape St. Blaize (N. 42, E. 11 miles) a single individual was taken by shrimp-trawl.

It was very badly preserved, the colour mostly rubbed off and replaced by a dirty gray. The back all over had been covered by rather closely placed small polyangular scarcely prominent disks of a diameter of 2–3 mm., now grayish brown with a whitish centre (sometimes like a papula); somewhat smaller disks of the same kind

were scattered over the head and the upper side of the brim of the foot; the upper lip of the marginal furrow of the anterior end of the foot brownish.—The length was 3 cm. by a breadth (of the back) of 2 and a height of 1·3; the frontal veil 14 mm. broad, the breadth of the mantle-brim 5; the length of the gill 16 mm. by a breadth of 5 and a height of 4; the breadth of the foot 22 mm., that of the brim 4.

The form as usual. The number of the lamellæ in the gill about 25, the vesicles along the rhachis very distinct; the external genital organs nearly without prominent folds; the caudal gland, very indistinct, seemed 7 mm. long.

The nature of the shell could not be determined.

The nervous system as usual. The skin contained a quantity of cells and groups of not calcified cells.

The mouth tube 3 mm. long. The *bulbus pharyngeus* (with the prominent rasp-sheath) 9 mm. long by a breadth of 7 and a height of 4. The mandibles clear reddish yellow, 7 mm. long by a height of 3·5, in a length of 2·5 mm. denudated. Their elements brownish yellow, 0·26 mm. long by a breadth of 0·14 and a height of 0·1; behind the pointed hook on each side 4 denticles, of which the upper the largest (fig. 22). The rasp of the *tongue* of a clear yellow colour, the number of series of plates was large, and so too the number in the rows. The plates with yellowish basal part, otherwise nearly colourless; the height of the 4 innermost (fig. 23) 0·035–0·04–0·06–and 0·08 mm., quickly mounting to 0·20, then gradually to 0·25, then decreasing; the height of the three outermost (fig. 26) was 0·035–0·06–0·10 mm. The inner half of the series, or thereabout, had the hook of the plates somewhat crooked (fig. 24); in the remainder it was straighter (fig. 25).

The gland. ptyalina not much developed. The liver brownish gray, contrasting in colour to the yellowish white hermaphrodite gland.

This form is distinctly different from the *Oscaniella granulata* described by me (*l.c.*, pp. 113–115, tab. ix., figs. 17–22) as being the *Pleurobranchus granulatus* of Krauss, which seems to be a Berthella.

It is possible that it represents a variety of *Osc. nigropunctata*.

BERTHELLA, Blv.

Berthella, Blainville. Man. de Malacol., 1825, pp. 469, 627, pl. xliii., fig. 1.

Cleanthus, Leach. Moll. Brit. syn., 1852, p. 28.

Berthella, Blv. R. Bergh, Die Opisthobr. d. Siboga Exp., 1905, pp. 68–73.

Berthella granulata (Krauss)?

Pleurobranchus granulatus, Krauss. Die Südafric. Moll., 1848, p. 61.

?Berthella granulata, Vayss. *l.c.*, 1898, pp. 268–271, pl. 15, figs. 14–16.

Pl. IV., figs. 27, 28; Pl. V., figs. 1–4.

Two specimens were procured, October 23, 1897, at Somerset West (False Bay). They were very much hardened.

They were similar in appearance, were 2·5–3 cm. long. The largest was 1·2 mm. broad, 1·4 mm. high; the breadth of the frontal veil was 10 mm., the length of the flattened gill 13 mm. by a breadth of 5, the breadth of the foot 15 mm. The animals were of one colour, yellowish gray.

The form about the same as that of *B. plumula;* on the mantle, which was quite smooth, a very fine white punctuation. The genital capilla without stronger folds. The shell was not visible externally.

The *shell* placed anteriorly and a little to the right, 6·5 mm. long, by a breadth in front of 3, very flattened, hard, yellow, with an anterior cuticular brim, the spire very small (fig. 27), white.

The *bulbus pharyngeus* whitish, of usual form, 7 mm. long by a breadth of 4 and a height of 3 mm. The mandibular plates yellow, thin; their elements (fig. 28, 1, 2) of a length of 0·16 and a height of 0·08; the hook is very pointed, without denticles (sometimes the point was split in 2 to 3 short needles), the lateral knots only slightly prominent, the inferior margin forming an angle. The yellow rasp of the *tongue* contained about 40 series of plates, in the sheath were about 43, the total number of rows therefore being 83; about 130 plates in the rows. The plates yellow at the base, otherwise nearly colourless, reaching a height of 0·25 mm., their form and relations (figs. 3, 4) being otherwise nearly as in the *B. plumula.*

Another specimen was procured at Kalk Bay, January 5, 1904. It had a length of 24 mm., the fine gill 11 mm. long; no trace of white punctuation of the mantle.—The *shell* 5 mm. long by a breadth of 2, rather hard, reddish yellow, the small spire white.

The *bulbus pharyngeus* 5 mm. long by a breadth of 4 and a height of 3; the mandibles (as well as the rasp) brownish yellow. In the rasp of the tongue about 38, in the sheath about 33 series of plates. The plates as usual.—The penis as usual.

Vayssière seems to have examined the original specimens of

Krauss, and with respect to the shell, the elements of the mandibles and to the lingual plates, the form here examined agrees with the figures given by Vayssière. On the other hand the "*Pleurobranchus* (*Oscaniella*) *granulatus*, Krauss," in my Monograph,* founded on a specimen purchased as belonging to the form of Krauss, is quite different, and does not even belong to the Berthellæ.

Berthella granulata (Krauss), var.

A specimen was procured from Hout Bay by dredge, December 22, 1897, resembling the above.

It had a length of 3 cm. by a breadth of 2 and a height of 1·5; the breadth of the frontal veil was 11 mm., the length of the somewhat flattened gill 18 by a breadth of 4, and the breadth of the foot 16 mm. The animal was of a uniform grayish colour, no white punctuation being visible on the back.

The gill with about 25 pairs of lamellæ.

The mouth tube 3 mm. long. The *bulbus pharyngeus* 5 mm. long by a breadth of 2·5 and a height of 3·5; the elements of the yellow mandibles merely 0·14 mm. long by a breadth of 0·05 and a height of 0·05; otherwise quite as in the form above. The plates of the tongue as above, reaching a height up to 0·28 mm.

Four smaller (15–17 mm. long) individuals were procured at Gordon's Bay (in False Bay) at low tide. Their mandibles and rasp were quite similar to those of the other individuals, only that their elements were much smaller.

NUDIBRANCHIATA.

NUDIBRANCHIATA HOLOHEPATICA.

DORIDIDÆ CRYPTOBRANCHIATÆ.

ARCHIDORIDIDÆ.

R. Bergh, System der nudibr. Gasteropoden. Malacolog. Untersuch., iii. (xviii. Heft). 1892, pp. 1092–1094.

Archidoris, Bgh.

R. Bergh, *l.c.*, p. 1092;—*l.c.*, 1905, p. 93.

* *L.c.*, pp. 112–115, taf. ix., figs. 17–22.

Archidoris capensis, Bgh. n. sp.

One specimen, now very much hardened, was procured at Cape Point by large trawl; it had been first treated with cocaine.

The specimen was of a uniform white colour. Its length was 40 mm. by a breadth of 22 and a height of 12 mm.; the height of the rhinophores was 3, the diameter of the gill-aperture 5, the height of the gill-leaves 5 mm., the breadth of the brim of the back 7; the tentacles 2 mm. long; the breadth of the foot 11, of its brim 3 mm., the length of the tail 5.

The form oval, somewhat depressed. The back even, quite finely chagreened, with broad brim. The somewhat clumsy club of the rhinophores with numerous lamellæ, stiffened by closely set long very hardened spicules. The number of gill-leaves 6. The tentacles finger-shaped. The foot strong, the anterior margin with deep furrow, the upper lip with median cleft.

The cerebro-pleural ganglia somewhat long, the pedal short, pear-shaped. The eyes of a diameter of 0·22 mm., with large yellow lens; the otocysts measuring 0·16 mm. in diameter packed full with otokonia. The skin full of very hard long spicules of a diameter up to 0·025 mm., mostly lying in bundles sometimes irregular and star-shaped. In the interstitial connective tissue a mass of similar spicula.

The mouth tube 5 mm. long. The somewhat yellowish *bulbus pharyngeus* (inclosing the strong 3 mm. projecting rasp-sheath) 9 mm. long by a height of 5·5 and a breadth of 6 mm.; the lip disc covered by a colourless and not thin cuticula. The broad *tongue* with yellow rasp, the rhachis narrow, the number of rows about 28, in the sheath 33, the total number being thus 61; about 90 plates in the series on each side; the plates of the common hook form; the height of the outermost 0·14 mm., of the sixth 0·20, the height rising to 0·25 mm.

The salivary glands long, well developed, of a diameter up to 2 mm., reaching backwards to the liver, the ducts very short.

The stomach globular, 5 mm. in diameter, projecting from the cleft of the liver; the intestine 24 mm. long by a diameter of 1·5. The *liver* on the outside yellowish, its substance yellow, of conical form, its fore-end obliquely truncate, 17 mm. long by a breadth anteriorly of 10.

The oval pericardium 10 mm.; the pericardio-renal organ somewhat flattened, 1·5 mm. long.

The thin layer of the whitish *hermaphrodite gland* contained in its lobules ripe genital elements. The anterior genital mass of irregular

meniscus-form, 14 mm. long by a height of 11 and a breadth of 5, yellowish white and white; the spermatotheca pear-shaped, 5 mm. long, the spermatocysta globular, of 3 mm. diameter; the efferent ducts without any trace of armature.

This form seems to belong to the genus Archidoris.

2. Archidoris granosa, B. n. sp.

Pl. V., figs. 16–18.

At Tongaati River mouth (NW. by N. $\frac{1}{4}$, N. $5\frac{1}{2}$ miles) an individual was procured by large dredge, from a depth of 36 fms. and hard ground (December 20, 1900). Two others were procured at Woodstock beach (Table Bay).

They were very hardened and quite stiff, 20–25 mm. long by a breadth of 13–19 and a height of 0·8–1·0, the breadth of the brim of the back 3–4, that of the foot 8–10, the tail 3–4 mm. long.—The colour of the living animal seems to have been yellowish, but is now a yellowish white.

The form as usual: the back all over covered with more or less small nodules of a diameter up to 7·5 and a height to 0·75 mm. (fig. 16); along the middle of the back sometimes a series of somewhat larger nodules, which formed a sort of median crest; the gill seemed formed of 8-leaves about 2 mm. high (when retracted).

The eyes, which were nearly sessile, of a diameter of 0·08 mm. with large yellow lens; the otocysts of a diameter of 0·08, full of otokonia. The skin everywhere with masses of hard spicules, which ascended through the nodules of the back.

The whitish *bulbus pharyngeus* with prominent rasp-sheath 4–6 mm. long by a height of 4–5 and a breadth of 3·5–4; the lip disc covered with a strong colourless cuticula. The very slightly yellowish rasp of the *tongue* seemed to contain 25 series of plates, the rasp-sheath 20, the total number of rows thus being 45. The plates colourless; the height of the outermost (fig. 18), about 0·06 mm., rising to 0·22; of the common hook-shaped form (fig. 17).

The large stomach 8 mm. long by a breadth of 3·5, very projecting; the liver yellowish white.

The form here examined seems to be an Archidoris, but could not, on account of its hardened state, be sufficiently examined. It would perhaps be preferable not to give a specific denomination.

2. Archidoris ? ? scripta, Bgh. n. sp.

Color albidus, notæo punctis et striolis nigris interruptus; margine limbi dorsalis flavo.

Pl. XI., figs. 19–25.

Of this form three individuals were sent, procured off the Hongazi River by dredge, now unfortunately very hardened and stiff.

The lengths of the specimens were 10, 15, and 21 mm. The largest had a breadth of 13 and a height of 7 mm.; the brim of the back 4; the height of the gill-leaves 2·5; that of the rhinophores 2·5; the length of tentacles 1·5 mm.; the breadth of the foot 5·5, and the length of the tail 3·5 mm.—The colour was white; the back showed, irregularly spread, very finely punctuated dots and stripes (fig. 19); the margin of the brim of the back yellow; the sole of the foot with clear, grayish shades. A white intestine shone through the middle of the back and of the foot.

The circumference oval, the body somewhat depressed, the back smooth, its brim rather broad; the rhinophores and the gill with its 6-leaves, both situated rather before and behind. The tentacles conical; the foot rather broad, with prominent brim, its anterior margin with deep furrow and its upper lip medianly cleft; the tail projecting behind the body proper.

The central nervous system as usual. The diameter of the eyes 0·14 mm., the lens very yellow; the diameter of the otocysts 0·10; they were quite packed with otokonia; in the lamellæ of the club of rhinophores some long, very calcified spicules of a diameter of 0·007 mm.; no spicules in the tentacles; the skin of the back with numerous, very calcified spicules (fig. 20), mostly of a diameter of 0·013–0·016 mm.

The buccal tube strong, 2 mm. long. The whitish *bulbus pharyngeus* 3 mm. long, with strong prominent rasp-sheath; the lip disc with nearly colourless rather thin cuticula. The *tongue* broad; in the clear-yellowish rasp 16 plates, in the rasp-sheath 15, of which the two hindermost are not fully developed, the total number of plates being thus 31. The plates nearly colourless; the height of the innermost 0·08, of the outermost 0·04 mm., of the next 0·08, rising to 0·20 mm. The number of plates in the rows up to 42. They were of the common hook form (figs. 21–24), the outermost somewhat different (fig. 24*a*), but missing (fig. 21).

The white salivary glands flattened, lobate at the margin, 2 mm. long.

The liver 10 mm. long, brownish, its sides covered by the rather thick layer of the yellowish white hermaphrodite gland, in the lobes

of which there were no ripe genital elements. The whitish anterior genital mass 5·5 mm. long; the long spermduct (fig. 25*a*) forms a coil of fine windings; the penis (fig. 25*b*) cylindrical, 5 mm. long, the glans moreover 2 mm., projecting in the thin præputium (fig. 25*c*), absolutely unarmed; the spermatotheca 2 mm. in diameter, spermatocyst half as large.

The generic position of this form in the system of the Doridida, as hitherto framed, seems very uncertain. The want of armature of the lip disc, the nature of the rasp and the unarmed penis would seem to denote an affinity to Archidoris, but the habitus is quite different and the back quite even.

Staurodoris, Bgh.

R. Bergh, System d. nudibranchiaten Gasteropoden, *l.c.*, 1892, p. 1093.

Eliot, Nudibranchiata. Fauna and Geography of the Maldive and Laccadive Archipelagoes, ii., 1, 1903, pp. 557–558.—On some Nudibranchs from East Africa and Zanzibar. Proc. Zool. Soc. of London, 1903, ii., pp. 363–364.

Corpus non durum, subdepressum, dorso tuberculato; foveæ rhinophoriorum sicut fovea branchialis tuberculis marginalibus elevatis valviformibus defensæ; tentacula brevia crassa, sulco marginali externo; branchia e foliis sat numerosis simpliciter pinnatis formata.

Penis et vagina inermes.

The genus belonging to the family of the Archidoridida has, like the other genera, the lip disc merely covered by a simple cuticula, the radula shows the narrow rhachis naked and the pleuræ with a series of hook-formed plates. It differs from the other genera by the protecting valves of the rhinophores and of the gill; the leaves of the last are, moreover, simply pinnate.

To the genus belong:

1. *St. verrucosa* (Cuv.).
   St. pseudoverrucosa, Jher.
   St. Januarii, Bgh.
   St. Bertheloti (d'Orb.).
   St. (*juv. ?*) *bicolor*, Bgh.
   St. ocelligera, Bgh.
   M. mediterr., atlant. or. et occ.
2. *St. d'Orbignyi* (Gray).
   Hab. ?

3. *St. calva*, Eliot.
   M. africano-indic.
4. *St. ? pustulata* (Abraham).
   M. Pacific.
5. *St. ? depressa, E.*
   M. africano-indic.
6. *St. ? pecten, E.*
   M. africano-indic.

St. verrucosa (Cuv.).

Pl. XI., figs. 26, 27.

The single specimen sent had been procured on the shore amongst rocks at St. James. It was unfortunately very hardened.

The length of the animal was 8 by a breadth of 5 and a height of 3 mm.; the breadth of the gill star 3, the height of the gill-leaves 0·5, the breadth of the brim of the back 1·3 mm.; the breadth of the foot 3·5 mm.—The colour yellowish white.

The form oval, somewhat depressed. The rhinophores protected on each side by a little valva. The back covered all over with small and quite small rounded tubercles of a diameter up to 0·5 mm.; the gill formed of about 20 (?) simple leaves the protecting valves rather small; the foot not narrow, the tail rather short.

The cerebral and pleural ganglia quite distinct, smaller than the roundish pedal. The eyes of a diameter of about 0·12 mm.; that of the otocysts 0·10, they were packed full of otokonia of a length up to 0·016 mm. The skin (of the back) full of very calcified long spicules of a diameter up to 0·025 mm.; spicules of the same kind in quantity in the valves, and in the lamellæ of the rhinophores.

The mouth tube 1·5 mm. long. The *bulbus pharyngeus* together with the very projecting rasp-sheath 3 mm. long; the lip disc covered by a yellowish cuticle. The *tongue* with yellowish rasp that contained 12 series of plates and in the sheath 15, the total number of rows thus being 27; in the series up to 39 plates.* The nearly colourless plates of the common hook form (figs. 26, 27); the height of the outermost 0·03, the height of the plates rising to 0·12 mm.

* The number of series of plates and the number of plates in the series seem to vary much in the *St. verrucosa*. In a small series of specimens of the typical form the number of series varied from 40 to 73, with a number of plates in the series from 41 to 95. In the *St. bicolor* these numbers were 28 to 33 and 33 to 36; in the *St. Januarii* the number varied from 39 to 61 and 40 to 65.

The whitish salivary glands were nodular and seemed to be shorter than in the typical species.

The liver yellowish, of conical form.

The form here examined seemed to be the typical *St. verrucosa* (Cuv.) of the Mediterranean Sea and from both sides of the Atlantic.

DISCODORIDIDÆ.

R. Bergh, System d. nudibranchiaten Gasteropoden, 1892, p. 1095. —Die Opisthobranchiaten d. Siboga Exped., 1905, pp. 98–118.

Geitodoris, Bgh.

R. Bergh, Die Opisthobranchiaten. Rep. on Alaska. Bull. of the Mus. of Compar. Zoölogy at Harvard College, xxv., 10, 1894, p. 162 (–168).

Corpus ovale, depressum, notæo minute granulato vel lævi; tentacula digitiformia; branchia e foliolis tripinnatis formata.

Armatura labialis e baculis minutis composita. Radula lata; rhachide angusta nuda; pleuris multidentatis, dentibus internis fortibus hamatis, externis tenuissimis.

Penis inérmis.

This genus differs from the other generic forms of Discodoridide especially in the dimorphism of the plates of the radula.

The genus now contains :—

1. *G. complanata* (Verrill).
   M. Atlant. occid.
2. *G. immunda*, B.
   M. Pacific.
3. *G. Capensis*, B. n. sp.
   M. Capense.

Geitodoris capensis, Bgh. n. sp.

Pl. XII., figs. 2–5.

One specimen was sent, dredged off Glendower Beacon; it was very much hardened.

When alive it was of yellow colour. In the preserved condition it was of a length of 18 mm. by a breadth of 11 and a height of 6; the rhinophores 2 mm. high, the brim of the back 3, the height of the gill-leaves 2·5; the breadth of the foot 7, of its brim 1·5 mm.

The colour of the back yellowish, that of the gill a little darker; the body otherwise whitish; the white intestines were visible through the hind part of the back and of the sides.

The form as usual. The rhinophores standing very far forwards, with prominent sheaths, the club with about 15 lamellæ. The back nearly quite even with rather broad brim; the gill consisting of 6 leaves, standing very far backwards. The tentacles short, finger-like; the foot rather large, with prominent brim; the tail short.

The central nervous system as usual. The eyes, with yellow lens, of a diameter of 0·16 mm.; the otocysts of a diameter of 0·09, nearly filled by a mass of otokonia mostly of a diameter of 0·008 mm. In the skin (of the back) a number of scattered spicules which were not long nor very much calcified; almost none in the lamellæ of the club of the rhinophores.

The yellowish *bulbus pharyngeus* about 3 mm. long, so hardened that a sufficient examination was quite impossible. The yellow lip plates (fig. 2) composed of closely packed rods of a height up to 0·035 and a diameter of 0·009 mm. The *rasp* seemed in its rows to contain about 30 more regular and 10–15 quite thin plates on each side of the naked rather narrow rhachis. The plates nearly colourless, transparent, hard, rising to a height of 0·33 mm. The plates erect, fixed to the cuticula only by their lower end; the plates of the larger inner part of the rows strong, of peculiar hook form (figs. 3, 4), with a strong outer border; the smaller outer part (fig. 5) showed, without any transition, merely very thin rather long plates.

The liver yellowish-white. The whiter hermaphrodite gland covering the largest part of the liver; in its lobules were ripe genital elements. The anterior genital mass white; the penis seemed to be unarmed.

The animal seems to belong to the genus Geitodoris.

DIAULULIDÆ.

R. Bergh, System. *l.c.*, 1892, p. 1097 (–1100).—Die Opisthobranchiata d. Siboga Exped., 1905, pp. 118–136.

Diaulula, Bgh.

R. Bergh, System, 1892, p. 1097.—Die Opisthobranchiata, *l.c.*, 1905, pp. 118–121.

1. Diaulula capensis, B. n. sp.

Pl. V., figs. 19–22.

At Mossel Bay (Seal Island, S. by W., 1½ miles) one individual was dredged from a depth of 11 fms. with bottom of sand and shells.

When alive it was "light-brown" in colour. In the preserved state it was very stiff and hardened, and of a yellowish white colour, the rhinophores only being brownish gray.

The length of the body was 25 mm. by a breadth of 15 and a height of 8; the height of the (retracted) rhinophores 2 mm.; the diameter of the gill hole 5 mm.; the height of the gill-leaves (retracted) 4; the brim of the back 3 mm.; the foot 8 mm. broad, its brim 2, the tail short.

The back was of a fine chagreen texture all over; the closely set (figs. 19, 20) small papillæ of a height up to 0·16 mm. The region of the (retracted) rhinophores somewhat prominent. The (retracted) gill composed of 8 apparently tripinnate leaves; the projecting anus subcentral.

The eyes of a diameter of 0·16 mm., with large clear-yellow lens. The lamellæ of the club of the rhinophores stiffened with long spicula. Coarse long spicules in quantity in the skin of the back, also ascending through the papillulæ and often projecting on their top (fig. 20).

The white mouth tube 2·5 mm. long. The white *bulbus pharyngeus* 4 mm. long by a height of 3, the lip disc covered by a strong yellowish white cuticle, the rasp-sheath rather projecting behind on the under side. The rasp of the strong *tongue* faint yellowish, containing about 15 series of plates, in the sheath 25, the total number of rows thus being 40; the number of plates in the rows about 35. The plates were nearly colourless; the height of the outermost 0·14 mm., the height rising to 0·285. The plates were of the usual hook form (fig. 21), the outermost somewhat slender (fig. 22).

The œsophagus 11 mm. long, the intestine appearing at the middle of the length of the liver, bending and passing backwards with a total length of 30 mm. by a diameter of 3. Its contents were animal matter and quantities of spicules pointed at both ends. The *liver* yellowish white, 12 mm. long by a breadth of 8 and a height of 7; with a deep median fissure through the anterior half of the upper side, divided by superficial furrows into several lobes, with a flattening of the under side towards the right. The gall-bladder on the left side of the cardia, 2 mm. high by a diameter at the summit of 0·4.

The grayish blood glands as usual.

The *hermaphrodite gland* with a whitish layer covering the upper side of the liver; the lobules contained ripe genital elements. The *anterior genital mass* white and yellowish white, 8 mm. long by a height of 6 and a thickness of 4·5; the large

prostata of a diameter of 4 mm., the globulous spermatotheca of 2 mm. diameter.

This form seemed to be a Diaulula and very likely a new species.

2. Diaulula ? morosa, B. n. sp.

Pl. V., figs. 23–26.

One specimen of this form was found on the shore at Mossel Bay.

It had a length of 14 by a breadth of 6 and a height of 3 mm., the height of the rhinophores 1·5, the diameter of the gill-aperture 2·5, and the height of the branchial leaves 1·5; the breadth of the foot 3·25 mm.—The back of this animal was of a uniform dark greenish gray colour, the foot white.

The form was elongate-oval, rounded behind and in front with somewhat prominent brim of the villous back; the lamellæ of the rhinophores not thin; the gill consisting of 10 simply pinnate leaves, protruding from the roundish gill-opening; the tentacles small; the foot shorter than the back, with prominent brim.

The back densely covered with rather low villi of a height up to 0·2 mm., stiffened with spicules in and often around them (fig. 23); the skin of the back containing masses of dark pigment and many spicules.

The *bulbus pharyngeus* 2 mm. long, whitish; the lip disc with a strong, much folded, colourless cuticle (no armature). The rasp of the *tongue* nearly colourless, with many rows of plates and many plates in the series; the plates colourless, reaching a height mostly of 0·016 mm., of the common hook form (fig. 24), the outermost (6) very thin and slender, with short basal plate, reaching a height of 0·14 mm. (figs. 25, 26).

The liver longish, 6 mm. long, clear grayish yellow.

The anterior genital mass whitish. The penis short, pear-shaped; the glans short, conical, with yellowish cuticle.

The generic position of this animal is quite uncertain; in many respects it would seem to belong to the Diaululidæ, but the leaves of the gill are simply pinnate.

THORDISA, Bgh.

R. Bergh, System, *l.c.*, 1892, p. 1098.—Die Opisthobranchiata d. Siboga Exped., 1905, pp. 121–124.

Thordisa punctulifera, B. n. sp.

Pl. VI., figs. 1–4.

In False Bay (Rockland Point bearing NW. $\frac{1}{4}$, N. $2\frac{1}{2}$ miles) three specimens were taken by large dredge, together with a species of

Chromodoris, from rocky bottom with many sponges in a depth of 23 fms.

The very hardened specimens varied in length from 11 to 16 mm. and resembled each other. The largest was 9 mm. broad by a height of 3·5; the height of the rhinophores nearly 2; the diameter of the gill aperture 1, the height of the gill-leaves 1·5, the breadth of the brim of the back 3, the breadth of the foot 3·5, and the length of the tail 1·5 mm.—The animal was of a uniform white colour, with small black roundish and more irregular spots spread over the back, sometimes too on the foot-brim; the brim of the back had perhaps been of another colour.

The form longish oval, with the broad brim of the back somewhat undulating. The back appeared under the lens covered all over with very small closely set tubercles of a height and diameter of about 0·10 mm.; the black points much larger than the tubercles, measuring up to 0·3 mm. The rhinophores with about 20 lamellæ and prominent end-papilla. The gill containing 5 tripinnate leaves. The tentacles appeared as very small prominences on the sides of the head. The brim of the foot not narrow, the tail short.

The central nervous system as usual. The eyes of a diameter of 0·12 mm.; the otocysts a little smaller, crowded with otokonia.

The small tubercles of the skin (fig. 1) with many cellular glands and spicules (fig. 2). The skin as well as the interstitial tissue crowded with calcified cells and long spicules.

The whitish *bulbus pharyngeus* about 3 mm. long, with prominent rasp-sheath; the lip disc clothed with a nearly colourless cuticle. The rasp of the *tongue* was nearly colourless and seemed to contain about 30 series of plates, the rasp-sheath about 30, the total number of rows thus being about 60. In the series on both sides of the rhachis (fig. 3) about 100 plates. The plates nearly colourless, the height of the 3 innermost 0·04–0·05–0·06, the height rising to 0·3 mm.; in the outermost it was 0·06–0·10–0·12–0·14–0·16–0·20, 0·25. They were of the usual hook form (figs. 3, 4); the 3 outermost being always of another form, erect, with rounded, finely pectinated end (fig. 4).

The salivary glands white, long, flattened. The posterior visceral mass (liver) 5·5 mm. long by a breadth of 3; flattened on the under side, yellowish.

The anterior genital mass 3·5 mm. long, whitish; the penis as well as the vagina without armature.

The tail of this animal is short, scarcely projecting behind the back, otherwise it resembles the *D. punctulifera*, B. (Neue

Nacktschnecken der Südsee II. Journ d. Mus. Godeffroy, Heft vi. 1874, taf. 1, figs. 19, 20), only known by the coloured figure of Graeffe.

Genus (?).

Doris (Gen. ?) *pseudida*, B. n. sp.

Pl. VI., figs. 7–8.

Near Table Bay (Lion's Head bearing N. 63 E., 34 miles) four individuals were taken by shrimp-trawl from a depth of 154 fms. on a bottom with black specks. The three individuals sent were very hardened.

Two were 15 and 23 mm. long. The third, which was dissected, had a length of 33 by a breadth of 20 and a height of 14 mm., the rhinophores 1 mm. high; the brim of the back 5 mm. broad; the round gill-hole of a diameter of 3 mm., the height of the retracted gill-leaves 3 mm.; the tentacles 1 mm. long, the breadth of the foot 6, the length of the tail 2 mm. The animal was uniformly coloured whitish; a fine white line along the margin of the back.

The form longish-oval, the brim of the quite smooth back not narrow, overlapping the head and the tail, the rhinophores perfoliate; the gill formed of 6 tripinnate leaves, the subcentral anal papilla 3 mm. high. The tentacles short, finger-shaped; the brim of the foot rather narrow.

Calcified groups of cells and spicules seldom occurred in the skin.

The *bulbus pharyngeus* 7 mm. long by a height and a breadth of 5, the rasp-sheath not prominent, the lip disc clothed with a thick white cuticle. The rasp of the *tongue* yellowish, containing 9 series of plates, in the rasp-sheath about 15, the total number of rows thus being 24; the rows seemed to have about 25 plates on each side of the very narrow rhachis. The plates nearly colourless, the height of the 4 outermost was 0·06–0·12–0·14–0·16, rising to 0·37 mm. The plates of the usual hook form (fig. 7), with hook quite even, the outermost small (fig. 8).

The white salivary glands long, their last two-thirds flattened, 1 mm. broad, the remaining hinder part very thin, the efferent duct not short.

The large stomach very prominent, 8 mm. long by a breadth of 6; its contents were animal matter with quantities of pointed hard spicules. The intestine 2·8 cm. long by a diameter of 0·5–1 mm. The yellowish white liver short, conical, 14 mm. long with a hollow base (for the stomach), of 11 mm. diameter. The gall-bladder 4·5 mm. high by a diameter at its summit of 3·5.

The genital system very little developed, the penis apparently unarmed.

This form does not seem to belong to any of the hitherto established genera or even families of the cryptobranchiate Dorididæ.

Genus (?).

Doris (Gen. ?) *perplexa*, B. n. sp.

Pl. VI., figs. 5–6.

Off Cape St. Blaize (N. by E. 8½ miles) a specimen was taken by large trawl from a depth of 39 fms. on stony bottom, and in company with the *Doriopsilla capensis*.

It was very hardened but soft, coloured uniformly whitish, the back anteriorly slightly grayish brown. It was 25 mm. long by a height and breadth of 7·5; the breadth of the foot 4 mm.

The form longish, highest in the middle of the length, the quite smooth back separated from the sides by a narrow white margin; the rhinophores well in front, 2 mm. high, with the club bent somewhat backwards; the gill placed quite behind, 3 mm. from the end of the body, formed by 6 simply pinnate leaves about 1·5 mm. high; the tentacles very small lobes; the foot rounded in front; the brim rather narrow, the tail very short, passing into the back without distinct demarcation.

The central nervous system as usual. The diameter of the eyes 0·12 mm. No spicules in the skin.

The mouth tube 4 mm. long. The whitish *bulbus pharyngeus* 5 mm. long by a height of 4·5 and a breadth of 3·5; the rasp-sheath large, projecting downwards; the lip disc with a rather strong, nearly colourless cuticle. The rasp of the large *tongue* nearly colourless; the number of series of plates could not be determined. The series seemed to contain up to 46 plates on each side of the inconspicuous rhachis. The plates nearly colourless; the length of the basal plate of the innermost 0·10 mm.; that of the 4 outermost (fig. 6) was 0·08–0·12–0·18–0·22, rising to 0·37. They were of the common hook form, with wing of the basal plate (fig. 5).

The white salivary glands very long.

The stomach 5 mm. long by a breadth of 2. The intestine 17 mm. long by a breadth of 0·5–0·75, filled with indeterminable animal matter with masses of needle-shaped pellucid spicules. The large yellowish white liver, conical, 15 mm. long by a breadth of 5.

The genital system very little developed; no ripe genital elements were seen; the penis seemed unarmed.

This form could not be referred to any of the hitherto established genera. It had a smooth back with very narrow margin, simply pinnate gill-leaves. Moreover, no armature of the lip disc, and uniform hook-formed lingual plates.

Genus (?).

Doris (Gen. ?) *glabella*, B. n. sp.

Pl. VI., figs. 9–13.

One specimen was procured off Buffalo Bay by shrimp-trawl from a depth of 30 fms. with sandy bottom, with stony Polyzoa. It was very contracted and hardened.

The colour was yellowish white, the gill more yellow, and the club of the rhinophores brownish. The length was 4 cm. by a height of 2·2 and a breadth of 2; the length of the club of the perfoliated rhinophores 3 mm.; the diameter of the prominent gill 11, its leaves—7 mm. long, the strong anal papilla 2 mm. high; the breadth of the foot 6 mm., the length of the tail 6.

The body somewhat compressed, the even back rounded, passing into the sides of the body. The 10 leaves of the gill mostly bifid or trifid, often branched, set in horseshoe form, simply pinnate (fig. 9).

The nervous system and the eyes as usual. In the skin, besides the enormous quantity of glandular cells, calcified cells and cell-groups, long, irregular grumous calcified spicula.

The mouth tube 6 mm. long. The *bulbus pharyngeus* 12 mm. long, 8 mm. broad, and 7 high; the thick rasp-sheath rather prominent; the lip disc with thick, yellowish cuticle, and a narrow armature of, as it were, chitinous cylinder-epithelium of a height of about 0·025 by a diameter of 0·007 mm. (fig. 10). The broad rasp of the *tongue* with about 60 series of plates, in the sheath moreover about 70; in the long rows on each side of the narrow naked rhachis about 200–300 plates. The plates clear yellow; the innermost (fig. 11) of a height of 0·08 mm., the three outermost 0·025–0·04–0·08 mm. high, the height of the plates from both ends of the rows abruptly rising to 0·25 mm. The plates were of the common hook form (fig. 12), never denticulated, the 1–2 outermost (fig. 11) small and somewhat irregular. A peculiar deformation was rather often seen in the different

series, and often several times in the same series (fig. 13); the point of the plates sometimes bifid.

The white salivary glands were long and thin.

The œsophagus 1·2 cm. long. The (liver-) stomachal cavity rather small; the intestine appearing at about the middle of the length of the liver, turning on the anterior genital mass and going backwards to the anal papilla. The length of the intestine 2·5 cm. by a diameter generally of 3 mm. The liver clear yellowish gray, rather short and thick, 12 mm. long by a diameter of 9, with a depression for the anterior genital mass.

The reno-pericardial organ rather roundish, of a diameter of 1·5 mm.

The anterior genital mass seemed of a rather complicated nature, but it could not be made out in the hardened specimen; it was about 15 mm. long by a diameter of 7–8. Its hinder part was formed by a sort of short pyramid, yellowish gray, of a height of 6 mm., by a base of 8, very likely opening in the vestibulum; the rest of the mass whitish and yellowish; the spermatotheca globular, of a diameter of 3·5; the coil of the windings of the vas deferens very large, consisting of a longer prostatic and a shorter muscular part; the penis 6 mm. long, without armature.

This form cannot apparently be placed in any of the hitherto known genera of Doridida; it agrees with the Chromodoris and the Halla in the simply pinnate nature of the gill-leaves.

CHROMODORIDIDÆ.

R. Bergh, System, *l.c.*, pp. 1103–1112.—Die Opisthobranchiata d. Siboga Exped., 1905, pp. 142–168.

CHROMODORIS, Ald. et Hanc.

R. Bergh, *l.c.*, 1905, pp. 143–162.

1. Chromodoris albolimbata, B. n. sp.

Pl. VI., figs. 18–24.

Off Sebastian Bluff (W. by N., ¾ N., 7 miles) one individual was taken by large dredge from a depth of 20 fms.; the bottom was coral and stones.

The animal was 15 mm. long by a breadth of 6 and a height

of 4; the height of the rhinophores 1·5; the entirely everted gill projected 2 mm., the diameter of the gill-star 6 mm., the length of the leaves up to 3; the brim of the back 1·5, the breadth of the foot 4 and the length of the tail 3 mm.—The colour clear reddish white, the brim of the back chalk-white.

The back quite even; the very fine gill with its 15 leaves (fig. 18) mostly extending out horizontally; the anal papilla submedian; the caudal and frontal veil about 1·5 mm. broad, the white brim finely punctuated; the tail projecting behind the back.

The diameter of the eyes 0·10 mm., the lens very clear yellow. The diameter of the otocysts 0·08. The brim of the back filled with sacks of very different size, stuffed with vesicles mostly 0·04 mm. in diameter.

The length of the mouth tube 2 mm. The whitish *bulbus pharyngeus* with the (fig. 19) prominent rasp-sheath 3 mm. long by a breadth of 2. The very strong (fig. 19) lip plate reddish brown, the elements, which were variously bent (fig. 20), of a length up to 0·06 by a diameter of nearly 0·005 mm. The rasp of the *tongue* yellowish, with many series of plates and a great number of plates in the series. The plates of usual form (fig. 23) and all with finely denticulated hook. On the very narrow rhachis small triangular pseudo-plates (fig. 21*a*) of a length short of 0·04 mm. The innermost plates denticulated as usual on both sides of the hook, 0·030 mm. high (fig. 21), the next 0·04 mm. high (fig. 22), the outermost about 8–10 plates only denticulated at the point (fig. 24).

The liver on the outside gray, in section black, 8 mm. long by a breadth of 3 and a thickness of 2·5, sausage-shaped; its fore-end and upper side covered by the whitish yellow hermaphrodite gland. The anterior genital mass whitish yellow, about 3·5 mm. long; the penis 1·5 mm. long.

This form is different from the 13 species of Chromodoris described by Eliot (*l.c.*, iv., 1904, pp. 386–399) from Zanzibar; perhaps it is identical with one of the many species described from the Indo-Pacific Seas.

2. Chromodoris euelpis,* B. n. sp.

Pl. VI., figs. 14–17.

One specimen was procured off Umloti River mouth by large dredge from a depth of 45 fms. and a hard bottom of sand and shells on December 18, 1900.

* Εὐελπις, Good Hope.

The specimen, killed with cocaine and expanded but somewhat hardened, had a total length of 18 mm. by a breadth of 4 and a height of 3 mm.; the frontal as well as the caudal veil projected 2·5 mm., the first 5 mm. broad, broader than the caudal; the height of the rhinophores 2, of the gill 2·5 mm.; the breadth of the foot 3, the length of the tail 7 mm.—The animal of a uniform yellowish colour, the back and the sides of the body very finely punctuated with black dots.

The form as usual, the frontal and caudal veil very pronounced, the back quite even; the anterior part of the brim of the back and the caudal veil showed a series of slightly prominent bags (as seen in so many Chromodorides) with contents of roundish and pear-shaped elements; the gill, far back on the back, formed of eight leaves; the brim of the back prominent; the tentacles short, finger-shaped, the tail rather long.

The dirty whitish *bulbus pharyngeus* 3 mm. long. The slight yellowish armature of the lip disc 0·50 mm. high by a breadth of 0·25, the elements (fig. 14) of a height up to 0·035 mm., with somewhat thicker bent end. The rasp of the *tongue* slightly yellowish with many rows of plates, and very many plates in the series. The plates nearly colourless, of a height up to 0·035 mm., the outermost measuring 0·016. They showed (figs. 15, 16) a plump bifid hook, the outermost of which (fig. 17) was more irregular.

The long salivary glands white. The liver grayish, sausage-shaped, 8 mm. long by a diameter of 2. The anterior genital mass whitish.

Perhaps this form represents a new species. No form of Chromodoris seems to have been hitherto described from the region of the Cape; this species does not agree with any of those from Zanzibar described by Eliot.

3. Chromodoris, sp.

Pl. VI., figs. 25–26.

Three specimens were procured in False Bay (Rockland Point bearing N. $\frac{1}{4}$ N., $2\frac{1}{2}$ miles) by large dredge from rocky bottom with many sponges in a depth of 23 fms., together with the *Thordisa punctulifera*.

The specimens, which were much hardened, varied in length from 13–17 mm. The largest was 13 mm. broad by a height of 4·5; the height of the rhinophores 2·5, the breadth of the brim of the back

3·5, the height of the gill 2·5 mm., the breadth of the foot 4, the length of the tail 2 mm. The animal was of a uniform whitish colour, the tubercles of the back white, the gill grayish.

The form was longish oval; the back covered all over with small rounded tubercles of a diameter of about 0·25 mm. These were also very distinct on the margin of the gill and of the rhinophore cavities; the gill seemed formed of about 12 simply pinnate leaves. The tentacles appeared merely as small tubercles.

The central nervous system, eyes and otocysts as usual. In the skin of the back calcified cells and spicules were in abundance.

The mouth tube 2·5 mm. long. The whitish *bulbus pharyngeus* 3·5 mm. long by a breadth and a height of 3, with rather prominent rasp-sheath : the lip plates large, nearly joining above and below, about 2 mm. high, 1 mm. broad, yellow; their elements (fig. 25) somewhat bent, 0·08 mm. high. The rasp yellow, with many series of plates. The number of plates in the series could not be determined. The plates (fig. 26) nearly colourless, of a height up to 0·08 mm., the hooks finely denticulated.

The salivary glands long, white, flattened.

The stomach large, 3 mm. broad, covering the anterior half of the liver. The posterior visceral mass (liver) yellowish white, short, conical, 7 mm. long by a breadth of 3·5.

This form is very likely identical with one of the many hitherto described species of Chromodoris.

APHELODORIS, B.

R. Bergh, System, *l.c.*, 1892, p. 1112.

Aphelodoris ? ? brunnea, Bgh. n. sp.

Pl. XI., figs. 28–29; Pl. XII., fig. 1.

One specimen was sent for examination. It had been captured at low tide on rocks at Kalk Bay.

The length of the animal was 4·7 cm. by a breadth of 1·5 and a height of 0·9 cm.; the diameter of the gill aperture was 3 mm., the height of the retracted gill 3 mm.; the breadth of the brim of the back 2·5 mm.; the foot 8 mm. broad, its brim measured 2.—The back was of a brown colour, the whole of the under side whitish, and on the sides of the body were some scattered grayish brown spots (the colour rubbed off?); the club of the rhinophores brownish, so, too, the rhachides of the gill-leaves.

The form of the animal longish, somewhat narrow and depressed, the body quite smooth. The rhinophore-sheaths, immediately behind the anterior end of the proper back, about 1·5 mm. projecting, their opening obliquely truncate; the rhinophores about 2 mm. high, the club perfoliated, the lamellæ rather numerous, thin. The gill rather contracted, composed of 8 tripinnate leaves, situated at the posterior end of the back. The tentacles short, as it were, refolded on the top. The foot rather narrow throughout its whole length, rounded before and behind; the tail 3 mm. long, not extending beyond the back.

The *central nervous system* quite as in allied forms. The nearly sessile eyes of a diameter of 0·12 mm., with yellow lens. The otocysts a little larger. In the lamellæ of the rhinophores no spicules, which are absent also in the skin of the body.

The whitish mouth tube rather long (5 mm.). The *bulbus pharyngeus* short, clumsy, 4 mm. long, whitish; the labial disc covered over by a rather strong, bright yellowish cuticle; the rasp-sheath hardly prominent. The rasp bright yellowish, containing 9 series of tooth plates, in the short and thick sheath 20 series, of which two are not fully developed; the total number of series 29. In the series about 40 plates. The plates nearly colourless; the height of the three outermost 0·07—0·10—0·16, rising to 0·25 mm. farther inwards. The outermost tooth (fig. 29*a*) more erect, all the others of the common hook form (fig. 29); the innermost (fig. 28) with low hook, 0·07 mm. in height.

The yellow *salivary glands* about 10 mm. long, their posterior half very thin, folded in the middle.

The œsophagus short, 2 mm. long. The stomach quite free, 13 mm. long by a diameter of 8, filled with yellowish animal matter of undeterminable nature. The intestine (26 mm. in length) running from the anterior end of the stomach straight backwards to the white conical anal papilla.

The posterior visceral mass (the liver) 20 mm. long by diameter of 7, the anterior end obliquely truncate, the posterior a little attenuated, roundish; the colour of the surface yellowish white, with a number of groups of small white nodules (lobules of hermaphrodite gland); the liver substance more yellow. The pear-shaped gall-bladder 4 mm. long.

The reno-pericardial organ (renal syrinx) whitish, of a length of 2 mm.

In the lobules of the hermaphrodite gland oogenous cells and bundles of zoosperms. The *anterior genital mass* white, somewhat compressed, 10 mm. long by a height of 4 and a breadth of 3 mm., rather hard and difficult to examine (fig. 1). The hermaphrodite

duct forms a little coil of windings (fig. 1*a*). From the anterior of the mucous gland (fig. 1*b*) there issues a long, rather bent and particular organ (fig. 1*cc*) that opens in the vestibulum genitale * (fig. 1*d*); the walls of this milk-white organ are rather thick, the cavity narrow (the prostatic part of a kind of vas deferens?). The globular spermatotheca (fig. 1*e*) of a diameter of 3·25 mm., at its side the much smaller pear-shaped spermatocyst. The efferent ducts of the genital system absolutely unarmed.

The systematic position of this form is very doubtful. It may, perhaps, be referred to the Chromodorididæ and placed in the neighbourhood of Aphelodoris.

POROSTOMATA.

DORIOPSIDIDÆ.

R. Bergh, *l.c.*, 1892, pp. 1114–1122.

I. DORIOPIS (Pease), Bgh.

1. D. CAPENSIS, Bgh. n. sp.

Limbus dorsalis serie macularum nigrarum ornatus.

Pl. XIV., fig. 4.

One specimen of this form had been taken off Umlanga River mouth by shrimp-trawl.

It was rather contracted and somewhat bent, rather soft. The *colour* was yellowish white, but the brim of the back showed at the margin somewhat roundish black patches; the tip of the branchial leaves grayish. The *length* was about 18 mm. by a height of 6 and a total breadth of 11, of which 3 on each side belonged to the brim; the breadth of the foot 7 mm., the brim 1·5 mm. broad, the length of the tail nearly 5 mm.; the diameter of the branchial star 7 mm., the length of the gill-leaves 3 mm.

The form was as in other Doriopsides; the brim of the even back very undulating; the rhinophores situated far forward, the gill far backward, consisting of 5 leaves; tentacles were not visible; the tail of the foot not short, projecting behind the body proper.

The central nervous system whitish, of usual relations, the buccal ganglia situated between the salivary glands (*gl. salivales*). The very

* A small, roundish multicellular ganglion (genitale) was attached in the neighbourhood of the vestibulum.

short-stalked eyes of a diameter of 0·10 mm. Hardened spicules were not found either in the lamellæ of the club of the rhinophores or in the skin of the back.

The yellowish *pharyngeal cone* nearly 2 mm. long; at its base the secondary salivary gland (*gl. ptyalinã*), consisting of two halves adjoining each other. The *bulbus pharyngeus*, whose foremost end lies in the pharyngeal cone, as usual; at its hinder end the small oval salivary glands proper. The œsophagus thicker but shorter than the bulbus. The posterior visceral mass (liver) yellow, 8 mm. long by a breadth of 4, truncate in front, the slit (so characteristic in the Doriopsidæ) in the hinder end, 3 mm. long.

The pericardium as usual; the blood gland yellowish white.

The *anterior genital mass* somewhat compressed, 2·5 mm. long, whitish and white (the mucous gland). The glans penis provided in the usual way with the (quincuncial) series of hooks; the slightly yellowish hooks (fig. 4) relatively strong, of a height up to 0·035 mm., the armature continued up in the vas deferens only for a short distance.*

The Doriopsides vary very much in colouration; still, this form seems to represent a new species.

2. Dor. callosa, Bgh. n. sp.

Pl. VIII., figs. 1–4.

Two specimens were procured by dredge at "Rocky Bank" in False Bay on rocky bottom in a depth of 17–27 fms.

One of them was 15 mm. long, the other 25 mm. by a breadth of 15 and a height of 6; the height of the rhinophores 2, the brim of the back 4·5 mm. broad, the diameter of the gill-aperture 3, the breadth of the foot 8 (of its brim 2).—The colour was whitish, the border of the back proper blackish, as also the fore-part of the back; there were besides a few black patches spread over the back. The back proper showed, all over, long spicules shining through, crossing each other irregularly in all directions; on the brim the spicula were more scattered, whiter, and mostly running transversely towards the margin. On the under side of the brim the radiation was less pronounced.

The form somewhat elongated; the white strongly foliated rhino-

* In the vagina of an individual of *Platydoris arrogans* I found the (torn out) penis of another individual (*cf.*, my "Malacol. Unters.," ii. (Heft xii.), 1877, p. 517). Sometimes individuals of Doriopsides and Pryllidiidæ are seen, in which the armature of the penis is wanting.

phores standing quite anteriorly; the back quite even, but with many small nodules at its junction with the margin. The gill-hole far behind, with prominent margin; the number of leaves of the gill 6. The mouth a fine pore, no visible tentacles. The foot rounded in front, the tail short.

The central nervous system as usual; the buccal ganglia (fig. 4) much smaller than the salivary glands. The eyes 0·14 mm. in diameter, with large yellow lens; the otocysts 0·10 mm. in diameter, filled with otokonia. The skin full of spicules of the most different sizes, form, and degree of calcification (fig. 3). The most of the long spicules of a diameter up to at least 0·05 mm., mostly smooth, sometimes a little thorny, mostly clear, sometimes even blackish. In the interstitial tissue masses of spicules; as also in the axis of the rhinophores, but almost none in the lamellæ.

The mouth tube about 4 mm. long, white. The glandula ptyalina about 1 mm. broad, rather thick. The transparent *bulbus pharyngeus* (fig. 4*a*) unusually, nearly 17 mm., long by a general diameter of 0·4 mm.; at its hinder end the salivary glands rather large (fig. 4*bb*). The œsophagus rather short and wide (fig. 4*c*); the intestine 6 mm. long. The liver a little flattened, in nearly its anterior half very compressed by the anterior genital mass, yellowish white, 10 mm. long by a breadth of 5, the cleft in the hinder end 1·5 mm. long.

The hermaphrodite gland clothing the largest part of the liver, of a similar colour, and with ripe genital elements in its lobules. The large anterior genital mass yellow and white, 6 mm. long by a height and breadth of 4. The form and the armature of the penis as usual (figs. 1, 2).

This form is specifically different from the *D. spiculata*.*

3. Doriopsis cæsia, B. n. sp.

An individual was taken by dredge near Roman Rock Lighthouse (SE. $\frac{1}{2}$ S., $1\frac{1}{4}$ miles) from a bottom of sand and shells in a depth of 10 fms.

The *living animal* is noted to have been "bluish." Preserved, it was whitish with the margin of the back more grayish, the rhinophores yellowish. The length was 14 mm. by a breadth of 7·5 and a height of 4·5; the height of the rhinophores 2, the diameter of the gill 4, the breadth of the brim of the back 3, the breadth of the foot 3 mm.

* R. Bergh, Die Nacktschnecken der Südsee. Journal d. Mus. Godeffroy, Heft xiv., 1878, p. 37. taf. ii., figs. 13–15.

The form of the body oval; the rhinophores rather large, the gill formed of 8 rather low (simply ?) pinnate leaves; the back quite even with undulating broad brim, the frontal veil rather large. The animal did not at first sight look like a Doriopsis.

The central nervous system as usual.

The glandula ptyalina large, brownish. The bulbus pharyngeus with the gland. salivales (and the buccal ganglia) as usual, the more brownish œsophagus rather short. The liver dirty-yellowish, sausage-shaped, 6 mm. long by a breadth of 3, the cleft in the hinder end 3 mm. long.

In the lobes of the thin layer of the hermaphrodite gland ripe genital elements, the ampulla of its duct strong, yellowish white. The anterior genital mass 4 mm. long by a height of 3·5 and a thickness of 2·5. The penis whitish; the everted prominent glans of a diameter of 0·25 mm., covered with about 25 quincunx-series of hooks of a height up to 0·08; the armature continued for a short distance up into the vas deferens, where the number of series seemed to be smaller; the hooks weaker, with larger basal part of a diameter of 0·04 mm.*

4. Doriopsis, sp.

Pl. VIII., figs. 5–6.

At Swart Klip (NE. $\frac{1}{4}$ N. 1 mile) an individual was taken by dredge from a depth of ten fms. and from a bottom of broken shells (November 17, 1902).

The contracted and very hardened specimen was 16 mm. long by a breadth of 6 and a height of 5, the breadth of the foot 5·5 and the length of the tail 5·5 mm.—The colour is now whitish, but had very likely been grayish, the back and the sides still retaining large patches of this colour; the rhinophores and the gill whitish.

The form as usual; the head rather large, the rhinophores with 10–12 strong lamellæ, and a small papilla at the top; the back quite even; the gill, standing nearly on the middle of the back, consisting of 6 pinnate leaves; the brim of the back as well as of the foot a little projecting; the whitish penis (fig. 5) projected as a cylinder of a height of 1 mm., and from its top the armed end of the vas deferens, 1·5 mm. long (figs. 5, 6): the tail prominent beyond the end of the back.

The central nervous system as in other Doriopsides.

* A dark-blue variety of the so varying *D. nigra* is known from the Southern Japanese Sea (R. Bergh, Beitr. zur Kenntniss d. Japan. Nudibranchien, I. Verh. d. k. k. Zool. Bot. Ges. in Wien, xxx., 1880, pp. 181–184).

The bulbus pharyngeus, the œsophagus, and the gl. ptyalina as in other Doriopsides. The liver short-conical, truncate in front, the length 7 mm., the colour yellowish gray; scarcely any fissure of the hinder end could be seen.

The everted part of the vas deferens (fig. 5) 0·14 mm. broad, showing 10–12 irregular quincunx series of thorns; these last a little bent, clear, colourless, mostly 0·02 mm. high (fig. 6).

DORIOPSILLA, B.

R. Bergh, System, *l.c.*, 1892, p. 1123;—*l.c.*, 1905, pp. 178–180.

Doriopsilla capensis, B. n. sp.

Pl. VIII., fig. 7.

Along with *Doris perplexa* a specimen of this form was procured by large trawl at Cape St. Blaize.

The rather stiff specimen measured 15 mm. in length by a breadth of 10 and a height of 7; the breadth of the nearly straight brim of the back was 2 mm., that of the foot 9. It was uniformly coloured whitish, the nodules of the back white.

The form as usual; the back covered all over with small rounded nodules; the gill situated far behind, formed of six leaves of the height of 2 mm.

The central nervous system as usual, the buccal ganglia seemed to be situated in its immediate neighbourhood. The eyes were somewhat flattened, of a diameter of about 0·25 mm. The back filled full of calcified cells, groups of cells, and spicules proper (of a diameter up to 0·06 mm.).

The gl. ptyalina white, flattened, 3 mm. broad. The very thin *bulbus pharyngeus* nearly 4 mm. long, the gl. salivales as usual, the œsophagus very short.

The large intestinal mass (liver) 10 mm. long by a breadth of 6; the length of the cleft in the hinder end 1·75 mm. The dirty-yellow liver on its sides for a breadth of 3 mm. covered by the transverse, yellowish white bands of the hermaphrodite gland, in its lobes ripe genital elements. The anterior genital mass meniscus-shaped, 6 mm. long, whitish, and dirty yellowish. The penis as usual, the diameter of the glans (fig. 7) at its point 0·10 mm.; the hooks small, reaching a height of 0·013 mm.

At South Head (E. by S. $\frac{1}{2}$ S., 25 miles) nine individuals of probably the same animal were caught by shrimp-trawl from a depth of 190 fms. with a bottom of green sand and black specks.

The (five) specimens sent, very hardened, varied in size from 17 to 23 mm. The largest was 12 mm. broad by a height of 7, the brim of the back 4 mm. broad, the breadth of the foot 7, the 6 gill-leaves 3 mm. high. The colour as above. Two individuals showed a few roundish small patches on the back.

The skin of the back quite as above. So, too, the thin *bulbus pharyngeus*. The liver sausage-shaped, 8 mm. long by a breadth of 5, the cleft in the hinder end 2·5 mm. long.

DORIDIDÆ PHANEROBRANCHIATÆ.

R. Bergh, System, *l.c.*, 1892, pp. 1129–1160.

Dor. phanerobr. non suctoriæ s. Polyceridæ.

R. Bergh, *l.c.*, pp. 1133–1147.

TRIOPA, Johnston.

Johnston, Miscell. Zool. Ann. of Nat. H., 1, 1838, p. 123.

R. Bergh, On the nudibr. gaster. Moll. of the North Pacific Oc., ii. (Dall, Sc. res. of the explor. of Alaska, ii.), 1880, pl. xiii. (v.), figs. 15–20; pl. xiv. (vi.), figs. 21–22; pl. xv. (vii.), figs. 12–13.—System d. nudibranch. Gasteropoden., *l.c.*, 1892, p. 1139; *l.c.*, 1905, pp. 185–187.

Corpus vix depressum; limbus frontalis angustior cirrhis granulosis ornatus, margo dorsalis cirrhis subclavatis instructus; rhinophoria retractilia clavo perfoliato; branchia paucifoliata foliolis tripinnatis; tentacula sat brevia obtusa canaliculata.

Armatura labialis et malaris nulla. Radula sat angusta rhachide nuda; pleuris dentibus lateralibus duobus majoribus et serie dentium externorum quorum modo intimus hamo rudimentario præditus.

Glans penis armata.

The rather narrow frontal brim is provided with somewhat granular appendages, and the margin of the back with more club-shaped ones; the gill is formed of a few (3–5) tripinnate leaves. The lip disc is clothed with a simple cuticle. The rasp of the tongue not broad; the rhachis naked; the pleuræ contain two large lateral plates and a series of smaller flattened plates. The glans of the penis armed with series of hooks.

Some few species of the genus are known .—

1. *Tr. clavigera* (O. Fr. Müller).
M. Atlant., Mediterr.

2. *Tr. lucida*, Stimpson.
   M. capense.
3. *Tr. Catalinæ*, Cooper.
   M. Pacific.
4. *Tr. Yatesi*, Angas.
   M. Pacific.
5. *Tr. longicornis*, B.
   M. Indic.
6. *Tr.* (?) *gracilis*, Pease.
   M. Pacific.
7. *Tr.* (?) *tristis*, B.
   M. Indic.

Triopa lucida, Stimpson.

Stimpson, Descr. of some new Marine Invertebrata. Proc. of the Ac. of Nat. Sc. of Philadelphia, vii., 1856, p. 388.

Pl. XII., figs. 6–7.

One specimen was sent, procured near Tugela River mouth, along with *Idaliella amœnula.*

The animal is now of a uniform whitish colour.* The length is 9 mm., by a breadth of the body proper of 3·5 and a height of 3; the length of the papillæ of the back reaching up to 3 mm., that of the leaves of the gill 2·5; the breadth of the foot 4 mm.

The head with perpendicular mouth; the tentacles truncate, somewhat folded up. The frontal brim rather narrow with 8 appendages of different sizes, the highest somewhat nodular in their upper half. The margin of the back otherwise not projecting, but rising through its whole length in club-shaped appendages, on each side 15–17 (Stimpson mentions a number of about 40 in all). The clubs (fig. 6) mostly of about the same size, slightly nodular (in their upper half), the lower half stuffed with long strong spicules, and in the point of the club a roundish bag.† The back smooth; the gill consisting of 3 strong, quite separate leaves, of which the lateral are bifid; the anal papilla as usual. The sides of the body rather high. The foot at least as broad as the body proper.

The intestines shone dark-grayish through the foot.—The nervous system as in the typical species. The short-stalked eyes of a

* According to Stimpson the "colour is uniform transparent white, except that the tentacles, branchiæ, and appendages are all of yellowish colour towards their extremities. Length 0·8 inch. Simon's Bay, Cape."

† Cf. Bergh, Polyceraden, *l.c.*, ii., 1881, p. 642.—Bergh, Alaska (Dall), ii. 1880, p. 264, pl. xiii., figs. 16–17.

diameter of 0·075 mm.; the otocysts of a diameter of 0·08 mm., filled with otokonia of a diameter up to 0·009 mm. The skin of the back, the appendages of the back and the stalk of the rhinophores (but not the lamellæ) full of very long, very hardened spicules of a diameter up to 0·035 mm. The interstitial connective tissue filled with spicules.

The *bulbus pharyngeus* scarcely 1 mm. in length; the hardened state of the organ did not permit a thorough examination. The lip disc only clothed with a thin cuticle. The number of rows of tooth-plates altogether perhaps about 55, on the outside of the lateral plates about 15 outer. The plates were nearly colourless; the length of the second lateral plate was 0·06 mm., that of the first of the outer plates 0·037, of the outermost 0·029 mm. The first and second lateral plates (fig. 7*ab*) as formerly described * in *Tr. clavigera*, so too the outer plates (fig. 7*c*).

The posterior visceral mass grayish brown, the anterior genital mass whitish. The armature of the glans was not seen.

The form here examined is no doubt the *Tr. lucida* of Stimpson, which hitherto was only known from his imperfect description.

NEMBROTHA, Bgh.

R. Bergh, System der nudibranchiaten Gasteropoden, *l.c.*, 1892, pp. 1144–1145.—Die Opisthobranchiata d. Siboga Exped., 1905, pp. 194–202.

Corpus limaciforme, fere læve; rhinophoria retractilia clavo perfoliato; branchia in medio fere dorsi sita, paucifoliata, foliolis bi- vel tripinnatis; tentacula brevia lobiformia; podarium angustius.

Armatura labialis debilis vel nulla. Radula non lata; rhachis dente subquadrato applanato; pleuræ dente laterali (primo) falciformi et dentibus externis compluribus depressis simplicibus.

Glandula hermaphrodisiaca hepate connata; prostata nulla; glans penis aculeis vel hamis armata.

Outwardly the Nembrothæ are not always easily to be distinguished from the Trevelyanæ; the *number of their branchial leaves is smaller* than in this genus, but the anatomy shows very important differences. The nature of the *rasp* is very different; and the *hermaphrodite gland* clothes (as common in other allied forms) the liver; there exists no special prostata, and the (glans) *penis* is armed.

* R. Bergh, Beitr. zu einer Monogr. d. Polyceraden, ii. Verh. d. k.k. zool. bot. Ges. in Wien, xxx., 1881, p. 643. taf. xiii., fig. 9*ab*; taf. xiv., figs. 2–3.

A small number of species is known hitherto, excepting the *N. gratiosa* of the Mexican Gulf,* only from the Philippine Seas (Cap) and the Pacific Ocean.

1. *N. nigerrima*, Bgh.
2. *N. Kubaryana*, B.
3. *N. diaphana*, B.
4. *N. gracilis*, B.
5. *N. morosa*, B.
6. *N. cristata*, B.
7. *N. gratiosa*, B.
8. *N. rubropapulosa*, B. (Siboga).
9. *N. lineolata*, B. (Siboga).
10. *N. Amitina*, B. (Siboga).
11. *N. capensis*, Bgh. n. sp.
12. *N. sp.* (*Semperi*, B.).
13. *N.* (*?*) *rubro-ocellata*, B. (Siboga).
14. *N.* (*?*) *Edwardsi* (Angas).

Nembrotha capensis, Bgh. n. sp.

Pl. XII., figs. 8–17.

Of this form I had three specimens to examine, procured at rocks, Kalk Bay.

The two larger were examined by dissection, more particularly the largest. When alive the colour was "dark blue."

The *length* of the specimens was 3·8–4·2 and 6·7 cm. The latter, the largest, had a height of 2 cm. at the gill, which was about 8 mm. high; the breadth 1·2 cm., that of the back proper 1·1; the breadth of the foot 7 mm., the height of the club of the rhinophores 4 mm.

The colour was uniformly deep blackish blue; the sole of the foot somewhat yellowish white.

The *form* of the animal, as usual in the Nembrothæ, rather compressed. The short tentacles, as it were, refolded on the top; the sheath of the rhinophores somewhat prominent, the club of the conical rhinophores with about 30 lamellæ and a black terminal papilla. The true back limited by a low brim; the gill situated before the middle of the back, the number of the gill-leaves 7, their form as usual. The anal papilla completing the gill ring 1·75 mm. high. The foot as usual in the Nembrothæ.

* R. Bergh, Rep. on the Nudibranchs (Blake Expedition). Bull. of the Mus. of Comparative Zoölogy of Harvard College xix., 3, 1890, pp. 172–175. taf. ii., figs. 1–5; taf. iii., figs. 1–4.

The *central nervous system* as usual. The diameter of the almost sessile eyes 0·10 mm.; neither in the rhinophorial lamellæ nor in the skin were spicules seen.

The short mouth tube with the inside black. The clumsy *bulbus pharyngeus* (fig. 8) oval in circumference, with a breadth and height of 4 mm., of a length of 6, the rasp-sheath moreover projected 2 mm.; the labial disc yellowish white, the perpendicular mouth downwards, with strong grayish folds; the cheeks clothed with an especially downwards strong grayish cuticle. On the upper side of the bulbus the rather narrow palate shone blackish through, on each side accompanied by a strong yellowish or grayish white glandular mass (fig. 8). The rasp of the *tongue* yellow, containing (in the two specimens) 12 series of tooth-plates, in the sheath moreover 10–12 series, of which the two hindermost were not quite developed; the total number of series being thus 22–24. The median and outer plates yellow; the large lateral ones colourless, transparent; the breadth of the median plates 0·56 mm., the length of the lateral about 1 mm.; the plates, especially the lateral, were very hard. The median plates (fig. 9) of usual form, but scarcely with any thickening of the foremost edge; the lateral (figs. 10–12) very clumsy, broad, somewhat bent, with short simple hook; the number of outer plates was 5 (rather seldom 6), their form (figs. 13, 14) as usual.

Salivary glands of the usual kind were wanting, being represented by the glandular masses on the upper side of the bulbus pharyngeus.

The œsophagus rather short. The *intestine* rose to the surface of the hinder visceral mass (liver) at about the limit of its first and second third, made some large windings on the upper and right side of the genital mass, and ran on the right side of the liver to the black anal papilla; the whole length about 5 cm. by a nearly constant diameter of 2·25 mm.

The posterior visceral mass yellowish gray, 15–17 mm. long by diameters of 10–9, with rounded anterior and posterior end; the cavity of the *liver* (stomach) rather large, its substance somewhat more grayish than the surface, which was nearly quite covered by the thin yellowish layer of the groups of lobules of the hermaphrodite gland. The whole of the digestive tract was quite empty.

The *blood* gland blue, of oval form, 3·5–5·5 mm. long, rather thick, composed of quite small lobules; fixed to the bend of the intestine.

In the lobules of the *hermaphrodite gland* ripe sexual elements. The anterior *genital mass* pear-shaped, narrower towards the anterior end, 8 mm. long by a height and a breadth of 6–7; the connected efferent ducts projected moreover 3 mm., were black on

the outside and inside. The whitish seminal duct making several windings, when unrolled 2·5 cm. long, continued in the blackish *penis* sack (præputium) of a length of 4 mm., the inside of this with fine longitudinal folds, at its base the small glans. This last has the usual armature of (quincuncial) series of slightly yellowish hooks (fig. 15) rising to a height of 0·02 mm., the armature continued for a short distance up in the seminal duct. The spermatotheca (fig. 16*a*) globular, of a diameter of 2–3 mm., greenish blue on account of its dark contents (of usual kind); the spermatocysta (fig. 16*b*) smaller, whitish, pear-shaped, containing zoosperms. The mucous and albuminous gland whitish and white; into the anterior end opened a thin-walled bag (vestibular gland ?) (fig. 17) of the length of 4–5 mm. the inside of which showed closely set fine reticular folds.

The whole of the intestines was wrapt up in a loose, somewhat felt-like, colourless connective tissue, and the different parts of the intestines were connected by a similar substance.

The form here examined is certainly new; it approaches perhaps nearest to the *N. diaphana* of the Pacific Ocean (Aibukit).* Regarding the salivary glands and the presence of a vestibular bag, it seems to differ from the hitherto known species of the genus.

EUPLOCAMUS, Phil.

Euplocamus, Phil., Enum. moll. Sic., i. 1836, p. 103.
Kaloplocamus, Bgh., Beitr. zu einer Monogr. d. Polyceraden, 1. Verh. d. k.k. zool. bot. Ges. in Wien, xxix., 1880, p. 623 (27).†
Euplocamus, Phil. R. Bergh, System d. nudibranch. Gasteropoden, 1892, *l.c.*, p. 1145.

Corpus nonnihil elongatum, vix depressum; margo frontalis sicut margo dorsalis appendicibus arborescentibus ornati; rhinophoria retractilia, clavo elongato perfoliato; branchia paucifoliata, foliolis tripinnatis; tentacula auriformia; podarium sat forte.

Lamellæ mandibulares validæ, e baculis minutis dense confertis compositæ. Radula latiuscula; rhachis nuda; pleuræ dentibus lateralibus majoribus hamatis quasi cochleariformibus tribus vel duobus et serie dentium externorum minorum, applanatorum breviori vel longiori (5–35).

Prostata magna, spermatothecam et spermatocystam amplectens; glans penis armata.

* *L.c.* xi., 1877, pp. 454–457. taf. lv., figs. 15–16; taf. lvi., figs. 6–10.

† The generic name had been employed by Latreille (1809) for a Lepidopteron, somewhat later (1838) by Temminck for a fowl.

The frontal margin as well as the dorsal is provided with fine arborescent tufts, in the former more numerous, in the latter fewer in number. The retractile rhinophores with very perfoliate club. The gill composed of a few (5) tripinnate leaves. The tentacles ear-shaped; the foot rather well developed.

The strong mandibles formed of closely set fine staffs. The radula not narrow; the rhachis naked; the pleuræ with a few (3) strong hook-shaped lateral plates and a series of (5–35) rather flattened outer plates. The prostata large, embracing the two seminal bags; the glans armed.

The Euplocami form a transition link between the Polyceræ and the Plocamopheri, being more closely allied to the latter.

Only some few species are known, the validity of which even is not quite established :—

1. *E. croceus*, Phil.
   M. Mediterr.
   Var. *Atlantica*, Bgh.
   M. Atlantic.
   Var. *capensis*, Bgh.
   M. Capense.
2. *E. japonicus*, Bgh.
   M. Japon.
3. *E. pacificus*, Bgh.
   M. Pacific.

E. CROCEUS, Phil., var. CAPENSIS.

Pl. XII., figs. 18–24.

Four specimens of this form were sent for examination, procured off Great Fish Lighthouse, off Cape Hangklip, and off Cape Point Lighthouse.

When alive they were of a "greenish colour with small red spots."

They closely resembled each other, and had a length of 30–35 mm. They are now of a whitish colour, but the best preserved and the largest of them showed the gill reddish yellow, so too the arborescences of the frontal and lateral appendages; moreover, small reddish yellow spots were sparsely scattered over the back and on the sides of the body. In all the specimens fine white points, sometimes a little prominent, appeared on the body, and, in all, the intestines shone blackish through the right side of the body.

Two individuals were dissected.

In the largest individual (35 mm. long) the diameter of the frontal veil with its arborescences was 25 mm., the height of these last rose

to 8 mm.; the breadth of the back between the lateral arbusculi was 13 mm., the height of these rose to 11; the height of the body proper 13 mm.; the height of the rhinophores was 10, the length of the gill-leaves 7 mm.; the breadth of the head with the tentacles 16 mm., of the tentacles themselves 5; the breadth of the foot in front 15, that of the brim 3, the tail 6 mm. long.

The form of the animal as in other Euplocamis; the strongly developed, rather large, somewhat curved frontal veil had in all the specimens 8 arborescences, of which the outermost was a little larger. The head rather broad with ear-like tentacles (fig. 18); in the largest individual the mouth tube was inverted and the bulbus pharyngeus projected to a length of 6 mm. The sheath of the rhinophores low, in one specimen the organs were nearly quite retracted; the stalk was a third of the height of the whole organ; the club with about 40 lamellæ and short end papilla. The back somewhat convex, smooth, sloping backwards; from the narrow brim projected, at somewhat equal intervals on either side, in all individuals, 4 strong arborescent appendages, the first near the rhinophore, the last at the root of the tail. They were of the usual form (fig. 19), mostly tripinnate, the branchlets mostly more or less pointed; the mostly somewhat lower frontal arborescent tufts of the same nature as the dorsal. The gill formed of 5 sometimes bifid tripinnate leaves, situated at about the last third of the length of the animal. The truncate anal papilla 1·5 mm. high; at its root to the right the fine renal pore. The sides of the body smooth; the genital papilla in one individual contracted, in the other the everted penis with its præputium projected 7 mm. (fig. 20), and from its point also the armature of the seminal duct to a length of 0·5 mm. (with a diameter of 0·12). The foot not narrower than the back; the anterior margin straight with a simple furrow; the tail with a slight crest with small arborescent tufts.

The *nervous system* nearly quite as formerly described * in the *Eupl. croceus*, Phil. The lamellæ of the club of the rhinophores had no calcified cells nor had their stalk, and in the skin of the back only few and small, never true spicules.

The mouth tube 4 mm. long, wide. The whitish *bulbus pharyngeus* 6·5–7 mm. long by a breadth of 5·5–6·5 and a height of 5·75, its form and structure quite agreeing with that of the *E. croceus*.† The yellow mandibular plates (fig. 21) 3 mm. long, somewhat longer than in the typical form, otherwise as in this, as also its structure; the diameter of its elements 0·005 mm.‡ The rather broad, some-

* Cf. *l.c.*, i., 1880, pp. 628-629. taf. xii., figs. 10, 11; taf. xiii., fig. 3.

† Cf. *l.c.*, pp. 630–631.

‡ Cf. *l.c.*, p. 630.

what depressed, whitish *tongue* with a deep cleft for the yellowish or yellow radula (as far as could be determined by the nearly cartilaginous state of hardening of the bulbus); the rasp contained about 17 rows of plates, in the sheath moreover about 13, the total number of rows being thus about 30. On each side of the rather broad naked rhachis 3 strong lateral plates and a series of outer plates. The plates were yellowish; the length of the first lateral plate was (in a straight line) 0·40 mm., that of the first of the outer plates 0·20, of the last mostly 0·10 mm. The three lateral plates (fig. 22) as in the typical species,* as also the outer ones (fig. 22*a*), whose number rose to at least 22.

The *salivary glands* (12–13 mm.) long, rather thin, somewhat uneven, yellowish white, running along the œsophagus to the anterior end of the liver.

The *œsophagus* 5 mm. long. The stomach 8–9 mm. long by a diameter of 4–5, entering a little to the left in the cleft on the under side of the anterior end of the liver. The *intestine* under the gill rising to the surface somewhat to the left in the deep furrow of the liver, running forwards along the left side of the liver, with its bend overlying the stomach and anterior genital mass, and running backwards to the anal papilla; the length of the intestine 4–4·5 cm., the diameter 2·5–4 mm. The contents of the alimentary tract, especially of the intestine, blackish, consisting chiefly of pieces of different Bryozoa, fine sand particles and different spicula.

The posterior visceral mass (*liver*) 16–18 mm. long by a height and breadth of 11, yellowish, rounded behind; with a rather deep cavity on the right side of the anterior end for the pylorus and the anterior genital mass, and an oblique transverse furrow on the upper side from the region of the gill. The substance of the liver yellow, contrasting with the enveloping whitish hermaphrodite gland; the cavity small. No gall-bladder could be seen.

The pericardium, the blood gland, the kidney, and the pericardio-renal organ as formerly described.†

The whitish hermaphrodite gland forms a rather (2–2·5 mm.) thick layer; in its lobules ripe genital elements. The hermaphrodite duct with its ampulla as formerly described.‡ The *anterior genital mass* large, angularly rounded, of a diameter (in the two individuals) of 9–12 mm., whitish. The largest part of this is formed by the large *prostata* (with the spermatotheca); this mass is short and pear-shaped, 8–9 mm. long by a diameter of 3·5 and 6; the gland quite envelops the spermatotheca, only leaving its neck free. The spermatotheca pear-shaped, 7 and 7·5 mm. long by diameter of 3 and 5;

* Cf. *l.c.*, p. 632. † Cf. *l.c.*, 1880, p. 634. ‡ Cf. *l.c.*, 1880, p. 635.

the small spermatocysta also pear-shaped, of a length of 2·5–3 mm., in both individuals lying quite free at the neck of the spermatotheca. From the prostata issues the sperm duct, whose prostatic part forms a little bundle of windings and then passes into the strong muscular part; this last has a length of 2·75–3 cm., and was continued as the somewhat thicker *penis* of a length of 2·25–3 mm. The glans was in the two individuals quite everted (fig. 20), in one drawn back in the sheath (præputium) (fig. 23); the anterior part (about 2 mm.) of the seminal duct showed on its inside out to its mouth on the glans (fig. 23) a clothing with rows of hooks; the diameter of this clothed part was then 0·08 mm., and the end of it was (as often in the Polyceridæ) (fig. 23) everted. The hooks were colourless, of usual form, of a height up to 0·02 mm. (fig. 24). The albumino-mucous gland as usual.

The differences in outer form and anatomical structure from the typical species does not seem to me to be of sufficient value to justify the establishment of a new species. I regard the form examined as a variety of the *E. croceus* of the Mediterranean (and perhaps of the Atlantic) Sea.

An additional specimen captured off the Tugela River mouth showed some differences in its habitus, but certainly belonged to the same species.

This specimen had a length of 20 mm. by a breadth of the back proper of 6 and a height of 7 mm. The frontal veil showed 6 arborescences, and the back on either side 5 arbuscular appendages; the gill had the usual 5 leaves.

The whitish bulbus pharyngeus 3·5 mm. long by a height and a breadth of 3; the yellow mandibular plates as above. On the tongue 13 series of tooth-plates; in the rasp-sheath 9, the total number of series being thus 22; the plates as above, the number of outer plates as much as 18. The length of the first lateral plate was nearly 0·40 mm., that of the third 0·35; that of the outermost of outer plates 0·075–0·10–0·12, that of the innermost 0·16 mm.

The penis projected just as above.

KALINGA, Ald. et Hanc.

Alder and Hancock, Notice of a Coll. of Nudibr. Moll. Trans. Zool. Soc., v., 3, 1864, pp. 134–136, pl. xxxii., figs. 7–10.

R. Bergh, Malacolog. Unters., iii. (Heft xvii.). 1890, pp. 959–962. taf. lxxxviii., figs. 19–20; taf. lxxxix., figs. 46–47.

Corpus ovale, postice rotundatum, brevicaudatum; limbus fron-

talis sat angustus, digitatus, digitis papilligeris; margo dorsalis digitis similibus sed majoribus, parcis ornatus; rhinophoria retractilia, clavo perfoliato; branchia paucifoliata, e foliis magnis, omnino discretis, in orbem dispositis, tri- vel quadripinnatis composita; tentacula a lateribus disci oralis auriculatim soluta; podarium magnum, dorso latius.

Armatura labialis nulla. Radula seriebus confertis numerosis e dentibus uniformibus minutissimis et numerosissimis formata.

Prostata magna. Glans penis aculeis armata.

Body rather clumsy, oval, subangular, rounded behind; the back somewhat narrower than the foot, the frontal margin with a row of closely set papillated processes, the lateral with a few similar but larger appendages; the perfoliated rhinophores retractile within sheaths; the (oral) tentacles short, flattened; the branchia (non-retractile) formed of few (5) quadripinnate, large plumes, each standing separately (as in Hexabranchus) surrounding the vent. The foot very strong, larger than the back, and, like it, on the back covered with tubercles.

The lip disc clothed by a simple cuticle, without particular armature. The rasp shows many closely set series of tooth-plates, the number of plates in the series very great; the plates uniform, very small and with tricuspid hook.*

A large prostatic gland exists. The glans penis armed with thorns.

Only one species of the genus is hitherto known.

Kalinga ornata, A. et H.

Alder and Hancock, *l.c.*, 1864. pl. xxxii., figs. 7–10.
R. Bergh, *l.c.*, 1890, pp. 959–962.

Pl. XIII., figs. 1–5.

Two large specimens were captured off Amatikulu Conical Hill by shrimp-trawl; both were dissected. When alive the colour of the animals was a "light flesh or light brown."

The length of the individuals was 7·5 and 9·5 cm. by a breadth of 4·5 and 6 and a height of 2·5 and 2·7 cm.; the breadth of the back proper was 3·2 and 3·8 cm., its brim projected 7 mm., and the height of the (5) larger marginal papillæ reached up to 15 and 17 mm.; the length of the gill-leaves was 15–20 mm., the anal papilla projected 5 mm.; the height of the rhinophores 7 mm.; the breadth of

* The specimen formerly examined by me had been taken by angling, and the anterior viscera were torn out.

the head disc with the tentacles 3 and 2 cm. by a height of 1 and 0·5.

The ground *colour* of the back seemed to be grayish white, but the tubercles and cones whiter with mostly crimson top ; the margin of the rhinophore sheaths crimson, the club of these organs reddish with crimson tip ; the larger marginal and (2) posterior papillæ, as well as some of the smaller, crimson coloured, sometimes with yellowish tip ; the rhachides of the gill-leaves and their ends of the same colour ; the margin of the anal papilla crimson. The whole of the under side of the body grayish white ; but the sides of the body (foot) as well as the tail showed here and there the tips of the tubercles crimson coloured. The consistence of the animal somewhat coriaceous, but still rather soft.

The posterior part somewhat convex, covered all over with rather closely set, soft papillæ or tubercles of roundish form and very different size, reaching a diameter of 4 mm. and sometimes of the same height, they very often rise in a central (contractile) pointed cone (fig. 1) ; the sides of the body (foot) and the tail are covered with similar tubercles, but the cones are less pronounced. The anterior convex margin of the back with about 12 whitish, unequal, somewhat branched and papillated appendages, between which there are here and there small cones ; this row ends on either side with a somewhat larger papilla of crimson colour ; the under side of this frontal brim even. The lateral brim of the back bears at irregular intervals 5 larger conical appendages covered all over with small papillæ ; behind the gill, at the end of the back proper, two similar appendages. The brim of the rhinophore-sheath carries a row of small papillated appendages ; the strong club with about 30 thin lamellæ on either side. The diameter of the whole somewhat flattened gill was greater than that of the back ; every one of the (5) gill trees consisting of (4–) 5 diverging tripinnate or quadripinnate leaves. In the middle of the interbranchial area the truncate anal papilla (standing about at the limit of the second and last third of the back), and at its base to the right the renal pore. The head disc rather broad, somewhat semilunar ; the mouth perpendicular ; the free auricular parts of the tentacles short. In front at the base of the marginal brim of the back the genital papilla. The foot large, with a marginal transverse furrow in front, the border everywhere with small arborescent appendices.

The walls of the cavity of the body very thick.

The *central nervous system* of a breadth of 4·5 mm., whitish, wrapt up in a covering of closely attached connective tissue ; the different ganglia could not easily be separated ; the nerve-cells of a

diameter up to 0·25 mm.; gastro-œsophageal ganglia were wanting as in the allied genera, (Nembrotha) Euplocamus and Plocamopherus.

The nearly sessile eyes of a diameter of 0·12 mm.; the otocysts a little larger. In the lamellæ of the club of the rhinophores no spicula, which were almost absent in the skin (as in allied genera).

The whitish mouth tube 8 mm. long, its inside more grayish. The strong *bulbus pharyngeus* whitish, red or crimson on the outside and inside of the palate, the pharyngeal region and the cheeks and roof of the rasp-sheath (tectum radulæ); the length 17 and 22 mm. by a height of 13 and 26 and a breadth of 15 and 22 mm.; the lip disc and partly the inner mouth clothed with a whitish, downwards grayish cuticle; on the hinder end of the bulb projected the rounded head of the two lingual masses, and between and before them the short and not large rasp-sheath plunges. Against the white tongue contrasted the brownish gray rasp; that on the upper side (and quite in the same way in both specimens) appeared (fig. 2) as a rather broad wall; the length of this part was in the largest specimen 16 mm. by a breadth of 8, the anterior end was for a length of 10 mm. continued at the under side of the tongue; the hindermost part of the rasp was sunk in a valley and then backwards and downwards continued in the rasp-sheath. This last (15 mm. long) was a gray, rather thick-walled, compressed, longitudinally wrinkled bag, whose cavity showed the close set series of tooth-plates. The rhachidial part of the rasp seemed not quite narrow. The number of series of plates in the radula more than 100, and that of plates in the series scarcely less than a couple of hundreds. The series were for a great part rubbed off. The tooth-plates (figs. 3, 4) yellowish, uniform, small, the length of the body about 0·08 mm., the height of the hook about 0·075; the hook with two larger and a smaller lateral denticle.* Some few of the hinder series in the rasp-sheath were not fully developed. The state of conservation did not permit a more detailed examination.

The salivary glands about 3 cm. long, in their first fourth of a diameter of 2 mm., elsewhere thinner.

The *œsophagus* of crimson colour, contrasting against the grayish stomach, 15 and 17 mm. long by diameter of 10–15, marked off from the stomach by a slight constriction. The *stomach* broader in front, 18 and 26 mm. long by diameter of 13 and 11, entering in the transverse furrow of the liver to the right. On the inside of the œsophagus and the stomach fine longitudinal folds; the cavity empty. The *intestine* appears in the neighbourhood of the pylorus, runs to the

* Alder and Hancock (*l.c.*, p. 134) mention the tricuspid character of the tooth-plates.

left through the transverse and link furrow of the liver, then forwards, forming a bend on the upper side of the anterior genital mass, then runs backwards to the anal papilla; the length of the intestine 6 and 10 cm. by diameter of 7 and (3–) 5 mm.; the yellowish gray and blackish contents of the intestine were more or less crumbled animal substances filled with spicules, perhaps of Holothuriæ. The posterior visceral mass (*liver*) on the surface yellowish white, 3 and 3·5 cm. long by a breadth of 1·7 and 2·3 and a height of 1·3 and 2 cm.; the mass was rounded behind and before, the anterior half a little lower; a transverse furrow divides the mass on its upper side into two parts of nearly equal size; it is continued along the left side to the anterior end; the substance of the liver dirty yellow; the cavity rather small.

The *pericardium* large, 28 mm. broad by a length of 22; the ventricle of the heart 11 mm. long by a breadth of 9. The blood gland whitish, thin, of oval form, 17 mm. long by a breadth of 9, lying to the right within the genuflection of the intestine. The *reno-pericardial* organ whitish, flattened, 4 mm. broad; its duct 20 mm. long.

The *hermaphrodite gland* nearly clothing the whole liver with a whitish layer 2–4 mm. thick; in its lobules ripe sexual elements. The *anterior genital mass* (in the larger individual) 2·8 cm. long by a height of 2·2 and a breadth of 1·5; the efferent ducts moreover projecting 1 cm. The hermaphroditic duct forming a longish bunch of coils on the left side of the hindermost part of the genital mass. The spermatotheca is a long grayish pyriform bag of the length of 2 cm. by a diameter of 1; the vaginal duct about 4 cm. long, the vagina somewhat wider; the uterine duct 16 mm. long; somewhat about its middle hangs the small pyriform spermatocyst of a length of 4 mm., its duct about twice as long as the organ itself. The muscular first part of the seminal duct short, passing into the white, compressed prostatic part, that projects in a stronger, short continuation, ending in a strong, nearly globular ampulla of a length of 10 mm. by a diameter of 8; the continuation forwards nearly 2 cm. long. In the last lies the *glans penis;* its anterior end is somewhat leaf-like, it is entirely covered with yellow pointed thorns (fig. 5) of a length up to 0·12 mm.; irregular forms are rather often seen. The muco-albuminous gland very large, yellowish white and white. In the vestibulum opens a brownish, rounded gland 7 mm. in diameter.*

* The state of conservation of the anterior genital mass was not good.

The condition of the vas deferens was as formerly represented by me (Cf. *l.c.*, taf. lxxxiv., figs. 46–47).

The smaller individual showed the whole genital apparatus less developed; on the glans penis no armature could be detected.

Dor. phanerobr. non suctoriæ s. Goniodoridid.æ.

R. Bergh, System, *l.c.*, 1892, pp. 1147–1157.

IDALIA, F. S. Leuckart.

F. S. Leuckart, Br. animal. quor. descript. 1828, p. 15, fig. 2*ab*.

R. Bergh, Üb. die Gatt. Idalia, Leuck. Arch. f. Naturg. xlvii, 1, 1881, pp. 140–181 ; taf. vi–viii.—System d. Nudibr. Gasterop., *l.c.*, 1892, pp. 1155–1156.

Forma corporis sat alta. Notæum proprium sat applanatum cirrhis paucis seriatis vel omnino læve, margine prominente cirrigero. Rhinophoria juxta-marginalia non retractilia. Branchia postica, e foliis simpliciter pinnatis, in arcum dispositis formata. Podarium sat latum, cauda applanata continuatum.

Discus labialis annulo angusto hamulorum seriatim dispositorum armatus vel utrinque lamina mandibulari elementis similibus formata. Radula angusta; rhachide nuda, pleuris dente majori hamiformi et externo lamelliformi instructis.—Ingluvies buccalis fortis, fere sessilis.

Prostata magna ; glans penis hamulis armata.

The form of the Idaliæ is somewhat distinctive, not depressed. The rather flat back proper shows some cirrhi set in series or is quite smooth; the margin projecting, somewhat turned up and furnished with a series of cirrhi. The rhinophores stand apart from each other anteriorly, not retractile, with perfoliated club. The gill standing rather backwards, consisting of simple pinnate leaves quite distinct from one another, set in the form of an arch. The foot is rather large, continued in a short tail.—The bulbus pharyngeus with a strong suctorial crop ; the lip disc of the bulbus proper provided with an armature of densely set small hooks or with mandibular plates. The radula is narrow ; the rhachis narrow, naked ; the pleuræ contain a very large compressed upright lateral plate with plain or finely denticulated hook, and an outer small lamelliform plate.—The prostata is rather large ; the glans penis armed with hooks.

The genus is divided into two subgenera :

1. Idalia (proprie).

Notæum medium cirrhigerum. Discus labialis annulo hamigero instructus.

1. *Id. elegans*, Leuck.

M. Atlantic., Mediterraneum.

2. *Id. Leachii*, Ald. et Hanc.
M. Atlantic., Mediterraneum.
3. *Id. Mediterranea*, Jher.
M. Mediterraneum.
4. *Id. tentaculata*, Stimpson.
M. Chinense.

2. Idaliella, Bgh.

R. Bergh, *l.c.*, 1881, p. 145.

Notæum medium læve. Discus labialis lamellis mandibularibus instructus.

1. *Id. aspersa*, A. et H.
M. Atlantic.
2. *Id. pulchella*, A. et H.
M. Atlantic.
3. *Id. inæqualis*, Forb. et Hanley.
M. Atlant.
4. *Id. amœnula*, B.
M. capense.

Idaliella amœnula, Bgh. n. sp.

Color generalis animalis lacteus, notæum (anterius) linea mediana et laterali coccinea ornatum, rhinophoria flavescentia, cirrhi apice e flavo rubri; branchia et area branchialis coccineæ; latera corporis superne linea coccinea ornata; dorsum caudæ linea mediana coccinea.

Pl. XIII., figs. 6–11.

Of this beautiful form 5 specimens were sent, procured at rocks, Gordon's Bay.

Two individuals were dissected. The colour of the living animal was "pink."

The length of the animals was 8–13 mm. In the largest the breadth of the back proper was 5, the height 4·5 mm.; the height of the rhinophores 2, of the cirrhi 3 mm., the diameter of the gill 4, the foot 4 mm. broad, the tail 1 mm. long.—The ground colour was milk-white, on the anterior part of the back a rather thin median crimson line and another on each side of the back proper, somewhat broader and more irregular, all three lines uniting in front; the rhinophores yellowish; the upper third or sometimes half of the cirrhi reddish yellow; the area branchialis and the gill-leaves of crimson colour; along the upper part of the sides of the body a more or less interrupted line of similar colour, along the back of the tail a median line of the same nature.

The form as in other Idaliæ (fig. 6). The tentacles rather large, lobe-like; the rhinophores strong, not retractile, situated on the sides of the neck proper. The back with weak median crest, otherwise quite even; its prominent brim somewhat turned up, disappearing behind, and the back passing in the tail. The frontal brim carries 4, seldom 6 cirrhi, the lateral 8, but the hindermost always coalescent; the cirrhi pointed, finger-shaped, of nearly equal size, quite even; the brim quite even between the digitations. Behind the middle of the back stands the gill, consisting of 12, seldom 11, simple-pinnate, not large leaves, set in a wide arch (fig. 6), the hindermost somewhat smaller; the anal nipple a little behind the median leaf, at its base the renal pore. The sides of the body even. The foot nearly as broad as the back, its brim not narrow; the tail short.

The intestines shone grayish through the sides and through the foot.

The central nervous system seemed to be as in *Id. elegans* formerly described by me (*l.c.*, pp. 153–156).—The number of lamellæ in the club of the rhinophores did not seem to be large. The skin (of the back) scantily provided with spicules, which were looser, hardened and crumbling, yellowish.

The whitish *bulbus pharyngeus* small, 2–2·75 mm. long; more than the half of it belongs to the (suctorial) crop, that covers the whole of the bulb proper, is somewhat embedded in its upper wall, not connected with it by a short stalk, but opening in it through a slit. This crop (fig. 7) is of the usual structure. On the bulbus proper the rasp-sheath projects a little behind; the lip disc is provided with mandibular plates of a breadth up to 0·25 mm., the height of their elements (fig. 8) reaching 0·013 mm.—The *tongue* rather well developed; the narrow rasp nearly colourless, with erect tooth-plates (fig. 9). These last colourless; the height of the lateral plates 0·25, of the outer ones 0·08 mm. The number of rows of plates on the tongue 22–24, in the sheath 10–11, the total number of rows being thus 32–35. The lateral plates (figs. 9, 10*a*) of the form as in other Idaliæ, but the hook finely serrated. The outer plates (fig. 10*b*) also of the ordinary form.

The salivary glands (fig. 7*aa*) whitish, about as long as the bulbus pharyngeus.

The posterior visceral mass 8 mm. long by a diameter of 4; its posterior end rounded, the anterior with long and deep impression on the right and under side by the anterior genital mass. The mass shows only the hinder end of the brownish gray or grayish brown *liver* naked; this is elsewhere, on the whole of the upper side,

covered by the very thick layer of the whitish hermaphrodite gland.

The *hermaphrodite gland* showed ripe genital elements in its lobes. The *anterior genital mass* in one of the two individuals 3, in the other 6 mm. long, rounded quadrangular in circumference, plano-convex, whitish and white. As far as could be determined by the hardened state of the organ, the relations of the prostata and the seminal bags were as in the typical species. The muscular part of the seminal duct not short, passing gradually into the somewhat thicker, whitish penis of a length of about 1 mm. The glans armed in the usual way with hooks, this armature for a short distance continued up into the seminal duct, and in one individual the anterior end of the armature freely projecting from the glans (fig. 11) for a length of 0·28 mm. and with a diameter of 0·06; the height of the small hooks hardly exceeding 0·0055 mm.

NUDIBRANCHIATA KLADOHEPATICA.

R. Bergh, System, *l.c.*, 1892, pp. 999–1070.

Fam. TRITONIIDÆ.

R. Bergh, System der Nudibranchiaten Gasteropoden, 1892, pp. 1066–1070.

The family contains the typical Tritoniæ of Cuvier and the Marioniæ of Vayssière, the Tritoniopsis of Eliot,* moreover the Atthilidæ † with perfoliated rhinophores, which character otherwise is not seen in the Tritoniidæ, and now the Tritonidoxæ, different from all other Tritoniidæ by the absence of gills on the sides of the back.

* Eliot, "The Nudibranchiata of the Antarctic Expedition." Trans. of the Royal Soc. of Edinburgh., xli., 3, 1905. pp. 530–532, figs. 17–20.

The description of the rhinophores is rather unintelligible.

† R. Bergh, "Nudibranchiate Gasteropoder. ii. Den Danske Ingolf-Expedition," ii., 3, 1899. pp. 21–24; tab. iii., figs. 10–26.

TRITONIA, Cuv.

R. Bergh, System, *l.c.*, p. 1068.

1. Tritonia pallida, Stimpson.

Stimpson, Descr. of some new Marine Invertebrata. Proc. of the Ac. of Nat. Sc. of Philadelphia, vii., 1856, p. 388.

Eliot, the Nudibranchiata of the Antarctic Expedition. Trans. Roy. Soc. of Edinburgh, xli., 3, 1905. p. 528, figs. 11–54

Pl. XIII., figs. 12–15 ; Taf. XIV., fig. 1.

One specimen of this form was procured in False Bay (Buffalo Bay) by shrimp-trawl. It is now very hard and stiff, not very suitable for anatomical examination.

The length of the animal is 5 cm. by a breadth of the back proper of 1·5 and a height of 1·2 cm. ; the breadth of the frontal veil 11 mm., the height of the rhinophore sheaths 3 mm., that of the gills 4 mm. ; the breadth of the foot in front 13 mm., its brim 3, the length of the tail 7 mm. The animal is now uniformly coloured white.*

The form is as usual, elongated, subquadrilateral ; the frontal veil somewhat bilobed, with 4 digitations on either lobe (as also remarked by Stimpson), the outermost one being the usual spoon-like tentacle ; the sheaths of the rhinophores erect, tubular, with digitate margin, the club as far as could be detected of the usual sword-knot form. The back all over somewhat nodular, flattened ; the margin a little projecting, rising in about 12–14 gills of the usual kind and somewhat varying size (according to Stimpson there are 16 gills and between those smaller ones). The genital opening as usual ; the anus at about the middle of the body proper, under the sixth gill. The foot with a rather long slight marginal furrow, the brim not quite narrow ; the tail rather long.

The intestines were nowhere to be seen from without.

The whitish central nervous system as usual ; the nerve cells reaching a diameter up to 0·28 mm.

The strong *bulbus pharyngeus* 14 mm. long by a breadth of 8 and a height of 7·5 ; its form and structure as usual. The yellow mandibles rather elongated, 14 mm. long by a breadth of 4 and a

* The specimen captured by Stimpson in False Bay, Cape, was when alive "1 inch long, of transparent white colour with a few flake-white spots on the back —the filaments around the truncated extremity of the sheaths of the tentacles of a dark brownish colour ; a white line extends below and parallel to the branchiæ on the sides of the body."

convexity of 2·5; the length of the hinge 2 mm. (fig. 12); the masticatory edge not broad with some small and usually 4–5 series of clumsy denticles (fig. 13), reaching a height of 0·16 mm., the masticatory process rather short (fig. 12*a*). The *tongue* large, as usual, quite hardened, so that neither the number of rows of plates in the colourless radula nor in the sheath could be determined; the number of plates also in the rows could not be ascertained; it seemed to be rather considerable. The median as well as the first lateral plates yellowish, the rest colourless; the median plates of a breadth of 0·28 mm., the length of the first lateral 0·26, the height of the lateral rising to 0·28 mm. The median plates (fig. 1) of the usual form, as well as the first lateral (fig. 1) and as the following (fig. 14); towards the margin of the rasp the plates were sometimes of different form (fig. 15).

The salivary glands as usual. The œsophagus posteriorly dilated into a kind of stomach of a length of 8 mm. by a diameter of 4; the intestine as usual. The alimentary tract quite empty. The posterior visceral mass (*liver*) 2·5 cm. long by a diameter of 1, conical, the anterior end obliquely truncate (for the anterior genital mass); its substance grayish, covered nearly all over by the thick layer of yellow hermaphrodite lobes.

In these last were ripe genital elements. The *anterior genital mass* somewhat globular, 10 mm. long by 7 in diameter; the very strong ampulla of the hermaphrodite duct with its two coils constituting at least a fourth part of the whole mass; the seminal vesicle longish (5·5 mm. long); the albumino-mucous gland yellowish and whitish.

The form here examined is very probably the *Trit. pallida* of Stimpson.

A smaller individual was procured by dredge at Cape Morgan, another by shrimp-trawl off Great Fish Point Lighthouse.

They were 18–21 mm. long by a breadth and a height of the body proper of 5–6; the height of the gills reached 2·5–3 mm. The colour was (yellowish) white, along the side of the body (as mentioned by Stimpson) ran a thin white line. On the right side the intestine shone grayish through and behind the yellowish white hermaphrodite gland. The frontal veil showed all in all 10 digitations, and the margin of body 10–15 on each side.

The markedly whitish bulbus pharyngeus 5·9 mm. long. The yellow mandibles quite as above. The radula colourless, containing 33 series of plates, in the sheath 13, the total number of rows thus being 46. On each side of the median plates 32 lateral. The plates colourless, the breadth of the median 0·14 mm.

At a later date two specimens were procured off Constable Hill (NNE. 6½ miles) by large trawl from green mud and a depth of 33 fms. The living animal showed the "back of light flesh colour." One specimen was small, only 2·3 cm. long, but otherwise in respect to the frontal veil, the gills and even the everted glans penis entirely agreeing with the larger, which was more closely examined.

This last was 4·5 cm. long by a breadth of 1·8 and a height, with the gills, of 1·1; the breadth of the frontal veil 11 mm., the height of the sheath of the rhinophores 2 and of the club 3 mm., the height of the gills reaching up to 6 mm.; the breadth of the foot 14 mm.

The series of gills commenced with a small one, then followed 12–13 larger and finally came 5 small. The frontal veil on each side with 4 small fingers. The back quite even. The pointed conical glans penis projected straight out 5 mm.

The *bulbus pharyngeus* 13 mm. long by a height of 7 and a breadth of 8; the mandibles quite as above, the masticatory edge with some few (3–5) smaller and about 5 stronger series of flattened denticles. The cavity of the mouth colourless. The colourless rasp of the *tongue* seemed to contain 23 series of plates; the number of the lateral plates could not be determined. The plates as above; the breadth of the median 0·35 mm.

2. Tritonia indecora, Bgh. n. sp.

Pl. XIII., fig. 16; Pl. XIV., figs. 2–3.

Two individuals were procured off Cape Point by a shrimp-trawl. They were rather hardened and in a fair state of preservation; the largest was, as far as possible, examined anatomically.

The specimens had a length of 30–35 mm. The breadth of the back was in the largest 11 and the height also 11.

The colour was whitish all over. When alive, they were of a "pinkish colour."

The form was as usual; the narrow frontal veil with a slight median emargination, each side of which was provided with 11–12 pointed finger-like processes, the outermost slightly spoon-shaped. The rhinophores seemed of the usual kind; their sheath somewhat crenulated with a stronger outer lobe. The back quite even, the margin slightly projecting, rising (in the two individuals) on each side in 5–8 rather low arborescences (of a height up to about 3 mm.); between these here and there were some much smaller ones. The foot as above.

The intestines nowhere shining through.

The *central nervous system* yellowish red; the cerebro-pleural ganglia roundish, a little larger than the rounded pedal ganglia; the cerebro- and pleuro-pedal connectives short; the double chief commissure rather wide. The optic nerve long, the eye of 0·14 mm. diameter; the otocyst measuring about 0·10 in diameter.

The *bulbus pharyngeus* whitish, only the palate and the pharynx being black; the length was 10 by a breadth of 7 and a height of 6 mm The bright yellow mandibles 10 mm. long, together measuring in breadth 6 mm., and one only 3 mm.; the form about as in the other species, but the hinge a little larger, about 2·25 mm. long; the masticatory edge a little broader, with 5 rows of projecting denticles of a height up to 0·10 mm. The *tongue* whitish with yellow rasp, which behind at the tectum radulæ had a breadth of 6 mm.; the rasp contained 26 series of teeth, the sheath 13, the total number being thus 39; the rows had, on each side of the median plate up to 60 lateral. The plates were yellow; the breadth of the median was 0·25 mm., the length of the first lateral 0·18, the height of the lateral rising to 0·30 mm. The median plates (fig. 2) resembling those of the former species, but with the hook always rounded; the lateral plates (fig. 16, 3) as above.

The long, white, rather thin salivary glands as usual. The stomach-like œsophagus 8 mm. long by a diameter of 5, whitish and contrasting with the black pharynx; the intestine making a large arch, 13 mm. long. The contents of the digestive tract were a red mass of sponge, full of red spicules of a length up to 9 mm.

The posterior visceral mass, 16 mm. long by a diameter of 8, pointed behind, obliquely truncate before, with a large excavation for the œsophagus and anterior genital mass. The *liver* brownish gray, but nearly quite covered by the thick yellowish layer of the large lobes of the hermaphrodite gland.

In the lobules of the hermaphrodite gland ripe genital elements. The *anterior genital mass* triangular-rounded of a diameter of 7 mm., white, the ampulla of the hermaphrodite duct grayish; the coils of the sperm duct measured when stretched out 2 cm.; the seminal vesicle globular, of a diameter of 2 mm.

The nature of the frontal veil and of the gills, the colour of the palate and pharynx and the form of the median tooth-plates seem to justify the establishment of a new species.

TRITONIDOXA, Bgh. nov. gen.

Forma corporis ut in Tritoniis, ita quoque velum frontale margine breve-digitato tentaculis cochleariformibus sicut rhinophoria. Notæum læve limbo sat sato, sine branchiis.

Bulbus pharyngeus ut in Tritoniis, ita mandibulæ cum processu masticatorio, et ita radula.

This genus * differs from the other generic types chiefly in the *total want of branchiæ* on the sides of the back. Otherwise the group agrees almost entirely with the other Tritoniæ in the form of the body, the frontal veil with its peculiar tentacles, and the sword-knot-rhinophores. It has, too, the same form of the bulbus pharyngeus with its mandibles and of the armature of the tongue.

Tritonidoxa capensis, B. n. sp.

Pl. VIII., figs. 8–13.

One specimen of this form was taken by dredge off Glendower Beacon from a depth of 66 fms.; the bottom was broken shells and stones.

It was 3·2 cm. long by a breadth of 1·5 and a height up to 1 cm.; the breadth of the frontal (tentacular) veil was 11 mm., the height of the rhinophores 6, the breadth of the brim of the back 6 mm.; the breadth of the foot 11 mm., of its brim 3. It was of a uniform white colour.

The form of the animal, as in other Tritoniidæ, somewhat pointed towards the hinder end. The frontal veil (fig. 8) not much projecting, quite even, at the margin with 2–3 short finger-shaped processes on each side besides the tentacular. The margin of the rhinophore cavities somewhat prominent, even; the stalk of the rhinophores as high as the swordknot-like club. The back entirely even, its brim rather broad, very undulating, also quite even on the under side. The sides of the body rather low; from the genital opening the glans of the penis projected (very curved) for a length of 2·5 cm.; the small anal papilla at the base of the brim of the back behind the middle of the length of the body. The foot rounded in front, with a slight marginal furrow; the brim not narrow. On the left side an intestine shone grayish through.

The cavity of the body ending 14 mm. from its end.

The central nervous system as in other Tritoniidæ, the cerebro-pleural ganglia not quite as large as the pedal.

The white bulbus pharyngeus of typical form, 8 mm. long by a breadth of 6 and a height of 5 mm.; the muscular plate on the fore side of the mandibles was as usual. The *mandibles* measured in a straight line 6 mm.; they were yellowish, only the masticatory edge being brownish yellow; their form was as usual, but rather

* Δόξα, presumption, conjecture.

narrow and the hinder end more pointed (fig. 9); the masticatory edge about 0·14 mm. high, showing about 5–6 series of cones, whose point projected about 0·025 mm. (fig. 10). The *tongue* as usual, strong, the rasp nearly colourless, tapering anteriorly, containing 31 series of plates, in the sheath moreover 34, of which the three hindermost were not quite developed, the total number of series being thus 65. The number of lateral plates on each side of the median seemed to rise to 75. The median plates bright yellow, the lateral colourless; the breadth of the median 0·16 mm., the height of the lateral up to 0·16, that of the outermost 0·12. The median plates of the form common in the Tritoniidæ, but rather broad, with a clumsy short median hook and two similar a little smaller (fig. 11). The first lateral plate also typical, different from the rest (fig. 11); these were of the common hook form, but slender (fig. 12), the innermost more clumsy (fig. 11).

The whitish salivary glands as usual.

The œsophagus short, about 3 mm. long. The stomach partly lying on the left side of the liver, somewhat constricted in the middle, 9 mm. long by a breadth up to 4·5, empty; the longitudinal folds of the anterior part much stronger than those of the posterior. The intestine issuing from the stomach near its end, ending near the end of the liver.

The *liver* brownish yellow, conical, 11 mm. long by a breadth in front of 5; the anterior part was partly isolated from the rest by a deep cleft entering from the right side and a smaller one interpolated between the pylorus and the intestine.

The large lobes of the yellowish white *hermaphrodite gland* were spread over the upper side of the liver, and contained ripe genital elements. The rather thick yellowish coils of the hermaphrodite duct lay on the inside of the *anterior genital mass*. This last somewhat pear-shaped, 7 mm. long, white. The seminal vesicle globular, of a diameter of 2 mm.; the vaginal duct 2 cm. long. The *præputium penis* thin, reverted; the glans very long (3 cm.), its greater part (2·5 cm.) freely projecting, cylindrical, with pointed end (fig. 13); the seminal duct opened at its end.

ÆOLIDIIDÆ.

R. Bergh, System, *l.c.*, pp. 1002–1039.

JANIDÆ.

R. Bergh, System, *l.c.*, pp. 1036–1037.

Corpus nonnihil depressum, margo dorsalis papilligerus, bursæ

cnidogenæ nullæ; anus ut plurimum dorsalis, posticus medianus; rhinophoria ut plurimum perfoliata, tentacula brevia; margo anterior podarii angulis vix prominentibus.

Mandibulæ fortissimæ, margo masticatorius applanatus, aut edentulus aut denticulis crassioribus armatus. Radula ut plurimum lata et multiseriata; dentes, mediani sicut laterales, elongati hamati non denticulati.

Penis inermis.

The Janidæ form a very distinct group. The anus lies mostly dorsal, far backwards and median. But their most essential character is the possession of colossal mandibles, the flat masticatory edge of which is even or bears very strong denticles. The lingual teeth, median as well as lateral, are elongate, never denticulate.

The family contains a few genera, mostly very distinct.

I. Janus, Verany.

R. Bergh., Beitr., 1. *l.c.*, xxiii., 1874, pp. 597–605; vii., *l.c.*, xxxii., 1882, pp. 64–66.

Vayssière, *l.c.*, 1888, pp. 29–32.

Rhinophoria perfoliata, crista interrhinophorialis; anus dorsalis. Margo masticatorius latus dentatus. Radula multiseriata.

1. *J. cristatus* (delle Chiaje).
   M. Atlantic., Mediterr.
2. *J. ? sanguineus*, Angas.
   M. Pacific.

II. Janolus, Bgh.

R. Bergh, Rep. on the Nudibr., *l.c.*, 1884, pp. 18–23.—Malacolog. Unters., vi., 1. 1904, p. 6.

Rhinophoria perfoliata, crista interrhinophorialis; anus dorsalis. Margo masticatorius latus non dentatus. Radula multiseriata.

1. *J. hyalinus* (A. et H.), B.
   M. Atlantic.
2. *J. Australis*, B.
   M. Pacificum.
3. *J. cæruleo-pictus*, Cockerell et Eliot.*
   M. Californ.
4. *J. Capensis*, B. n. sp.
   M. Capense.

* "Notes on Californian Nudibranchs," Journ. of Malacology, xii., 1905, p. 48, pl. viii., figs. 12–16.

III. Proctonotus, A. et H.

Alder et Hanc., Nudibr. moll., Part ii., 1845. Fam. 3, pl. 42.

Rhinophoria simplicia, crista interrhinophorialis nulla; anus dorsalis.

Margo masticatorius non dentatus. Radula multiseriata.

1. *Pr. mucroniferus*, A. et H.
M. Atlant.

IV. Madrella, A. et H.

A. et Hanc., Notice, *l.c.*, v., 3, 1864, pp. 141–142.

Vayssière, Rech.—sur les Opisthobranches, 1903, pp. 88–92.

Rhinophoria papillata, crista interrhinophorialis nulla; anus lateralis.

Margo masticatorius non dentatus. Radula triseriata.

1. *M. ferruginosa*, A. et H.

Eliot, Nudibranchs from Zanzibar, i. *l.c.*, 1902. p. 71. pl. vii., figs. 14–16.

M. Indic.

2. *M. aurantiaca*, Vayss.
M. Mediterr.

Janolus capensis, B. n. sp.

Pl. VII., figs. 6–21.

One specimen was procured at "Rocky Bank," False Bay, by dredge (17–27 fms.) on rocky bottom, October 8, 1902; it was rather hardened.

It was 3 cm. long by a breadth of 1·5 and a height of 1·3 cm.; the height of the rhinophoria 5 mm., the length of the tentacles 3, the height of the dorsal papillæ 4 and of the anus 3 mm.; the sides of the body at the middle 5 mm. high; the breadth of the foot 12 mm., of its brim 2 and the length of the tail 2 mm.—The animal was uniformly coloured whitish yellow; the papillæ and the anus nearly colourless, semi-pellucid. The liver shone brownish through the back and the intestine whitish.

The form of the body as in other Janidæ. The mouth tube was turned up, the anterior of the bulbus pharyngeus somewhat prominent, the form of the head rather broad and its tentacles finger-shaped; the relations of the head to the foot quite as in other Janidæ.* The inter-rhinophorial crest median on the neck, not

* Cf. R. Bergh, "Beitr. zur Kenntn. d. Æolidiaden," 1. 1874, *l.c.*, p. 599, tab. vii., fig. 1*b*.

strong, somewhat compressed, the upper margin with several slight transverse furrows. Close to the crest the (scarcely retractile) not short-stalked rhinophoria; the club rather slender, with about 18–20 rather stout lamellæ and a rounded end papilla (fig. 7). The even back somewhat convex; the margin not very prominent, 1–3 mm. broad, densely set with perhaps 3–4 indistinct series of rather small papillæ; this margin in front reaching beyond the rhinophoria, only interrupted in the middle of the anterior and the hinder end of the back. The papillæ (*epinotidia*) as in other Janidæ placed without order, small; the outer quite small, the inner somewhat larger; here and there a solitary papilla was seen in the neighbourhood of the margin. The papillæ seemed nearly all present, and there was no trace of dropped larger ones. The papillæ of usual form, sometimes a little nodular (fig. 6). Quite posteriorly on the back, 3 mm. from its end, and submedian, still nearer to the right margin, the anal papilla, directed forwards, gaping, with strong folds (fig. 8), at its base behind a fine renal pore. The sides rather high, the genital papilla with two openings. The foot scarcely narrower than the back, the margin prominent, the tail short.

The *central nervous system* yellowish, nearly as in the *Janolus australis*, the large pedal ganglion lying on the outside of the cerebro-pleural.

The narrow lip disc with strong cuticle. The (fig. 11) huge *bulbus pharyngeus* 11·5 mm. long by a breadth and a height of 7 mm., in shape as in other Janidæ, the blackish anterior end of the mandibles projecting in the inner mouth; its sides are quite covered by the mandibles; on the somewhat concave upper and on the convex under side the strong (faintly reddish) yellowish transverse muscles, the hinder end formed by the lingual musculature. The mandibles (figs. 9–16) very powerful, their thickness in front and in the middle 3 mm.; the colour of the thicker parts mahogany brown, in the fore end and in the hinge blackish, the thinner parts reddish yellow; their length and their height equals that of the bulbus. They consist of a little shorter but stronger anterior part, flattened in the fore end, and a longer slightly quadrangular posterior. The anterior convex part has on the *outside* (figs. 10, 13) a deep somewhat curved perpendicular furrow for muscular insertion; before this the mandible is thicker, more convex, behind the furrow the part is more flattened. The longer posterior part is by a deep longitudinal furrow and border (also for muscular insertion) divided in two lips, a thinner superior and thicker inferior, somewhat concave beneath. The *inside* of the mandible shows (figs. 9, 11) the anterior part convex, prominent, before passing into the smaller foremost part of the outside, above

continued in a prominent black, even, connecting process. This anterior part is separated by a deep furrow from the posterior, that also through a longitudinal cleft and border is divided into two lips, a higher inferior and a lower and thicker superior, that is continued in the anterior part. The inferior edge of the mandible is quite even (figs. 9, 10). *Above*, the jaws are connected with a thick nearly black cuticle, consisting of longitudinal halves corresponding to the jaws. Below at the entrance into the mouth is a little yellow (black in front) lamina (fig. 11), 3 mm. broad, 2 long, with a crest in front (fig. 14) on the upper side. The thickness of the *M. transversus mandibularum* here 3·5 mm. Behind the *M. transv.* pass in two cartilaginous-looking strong plates (figs. 15, 16) of cellular structure with large clear round cells.—The narrow mouth cavity is filled by the short and keel-shaped *tongue* with broad reddish brown rasp. This last contained about 18 series of plates, in the sheath, moreover, at least 24 rows, the total number being thus probably 42. The rows seemed to contain about 50 lateral plates. The plates were all yellow at the basal part, otherwise nearly colourless; the length of the lateral plates rising to about 0·4 mm. The median plates narrow, with a weak pointed hook (fig. 17). The lateral plates quite as in other Janidæ,* rather narrow and slender, the hook a little bent (figs. 18, 19). The whitish salivary glands reaching backwards to the liver.

The œsophagus (fig. 20*a*) 10 mm. long, by a diameter of 2, with fine longitudinal folds. The presence of a stomach before the liver could not be determined. The large posterior intestinal mass, chiefly formed by the brown liver, somewhat flattened in front, rounded behind, 2 cm. long by a breadth of 1·3 and a height of 1·1 (fig. 20); distinct branches were not seen. In the liver anteriorly a roundish cavity (fig. 20). From this last issues the white *intestine;* for a short distance it perforates the liver, and appears on its under side running submedian backwards (fig. 20), then making a bend, and, further on, running in a furrow of the liver, lies first to the left, then obliquely crossing the liver going backwards on the *right side*, turning upwards (fig. 8) and ending in the anal papilla (figs. 8*a*, 20); the total length of the intestine about 5 cm. by a breadth of 3–4·5 mm.—The *contents* of the cavity of the liver and of the intestine white, consisting of hard masses of calcareous Bryozoa.

A ramification of the brownish black liver could not be ascertained or followed. The *epinotidia* (fig. 6) on the margin of the back were

* The number of series of plates was in *Jan. hyalinus* 16 (8 + 8), in *J. australis* 24 (16 + 8), the number of lateral plates in the rows in the former 12–13, in the latter up to 54.

slightly nodular, over the middle of their height a blackish gray mass shone through, up to this rose a thin-walled even tube; the point of the organs often flattened, and with a follicle.*

The renal mass behind the liver "being a network of tubes" † as in other Janidæ.

The *hermaphrodite gland* yellowish, lying to the right, embraced by the transverse and descending part of the intestine (fig. 20), roundish in circumference with a diameter of 10 mm., 6 mm. thick; the under side distinctly divided into some large lobes radiating from the centre; the thin whitish efferent duct issues from this deep centre. In the whitish lobules ripe genital elements. The *anterior genital mass* yellowish and yellow brown, somewhat compressed, 7 mm. long and high by a thickness of 5, on its inside a large coil of windings of the ampulla of the hermaphrodite duct; the white seminal vesicle, globular, 2 mm. in diameter. The yellowish *penis* (fig. 21) nearly cylindrical, its upper end recurved, 12 mm. long by a diameter of 2, consisting of the præputium, that shows many folds of the inside and at the bottom of its cavity a small whitish glans.

This form is certainly specifically different from the other known Janoli, in the epinotidia and its distinctive mandibles.

Off Cape Port Lighthouse (SW. by W., 4½ miles) a specimen very likely of the same species was procured by shrimp-trawl (December 5, 1902) from a depth of 29 fms. on fine sand bottom. The epinotidia are said to have been "red tipped."

The specimen had a length of 3·5 cm. and resembled the former, only the epinotidia had fallen off (not being left in the bottle) with the exception of those of the outermost series, where they had a length of 0·5–1·25 mm.

The *bulbus pharyngeus* 13 mm. long by a breadth of 11 and a height of 4·5. The mandibles not so high and the furrows on the outside and inside not so deep. The lingual plates longer than in the former specimen. The œsophagus, the intestine and the liver as described.

The position and form of the hermaphrodite gland as well as the anterior genital mass as described.

An additional specimen was procured off Buffalo Bay "by shrimp-

* According to Alder and Hancock (*l.c.*, Part 5, 1851) a distinct external orifice was visible in the living state in *Antiopa cristata*. Cf., too, my "Beitr. zur Kenntn. der Æolidiaden," I., *l.c.*, 1874, *l.c.*, p. 604, note 3.

† Alder and Hancock, *l.c.*, pl. 43, fig. 1, ii, *hh*.

trawl from a depth of 30 fms. and from sandy bottom with stony Polyzoa," it was very hardened; two others were taken in False Bay from rocky bottom with many sponges.

The length of the two largest was 3–3·5 cm. by a height of 0·8; the height of the rhinophores 5 mm., of the tentacles 2, of the epinotidia 0·5–3; the back 1 cm. broad, the foot 1·2, the marginal furrow continued along the side of the foot for 8–9 mm., the length of the tail 4.

The epinotidia in 2–4 series; the inter-rhinophorial crest very small; the anus submedian, 2 mm. high.

The *bulbus pharyngeus* 14–16 mm. long by a breadth of 9–9·5, and a height of 7–7·5, the furrows of the posterior part of the mandibles replaced by a thick edge (fig. 13); in general the forms of these organs is rather variable in different specimens, the thickness of the mandibles in front and in the middle of their length 3·5 and 4 mm. The *tongue* 3 mm. high and long, the length of the rasp-sheath 4–5 mm. (its long nearly horizontal pulpy end 2 mm. long). In the rasp about 18–20 rows of plates, and in the sheath 22–24; the number of plates in the series could not be determined. The plates as above.

GLAUCIDÆ.

R. Bergh, System, 1892, pp. 1035–1036.

GLAUCUS, Forster.

Glaucus atlanticus, Forster.

R. Bergh, Malacolog. Unters. ii. (Heft xvii.), 1890, p. 876.

One specimen was procured from rock pool, Muizenberg. Its length was with the tail 22 mm.; it agreed in all respects with the type.

TETHYMELIBIDÆ.

R. Bergh, System d. nudibranchiaten Gasteropoden., *l.c.*, iii., 1892, pp. 1039–1043.

Forma corporis quasi ut in Æolidiidis. Caput permagnum et cuculliforme; rhinophoria vagina magna retractilia, clavo per-

foliato; tentacula nulla. Epinotidia (papillæ dorsales) colosseæ sine bursis cnidogenis.

Bulbus pharyngeus rudimentarius, lingua et interdum quoque mandibulis destitutus. Hepar solidum vel fortiter ramificatum, ramis papillaribus non validis.—Penis inermis.

This family only contains two genera, Tethys and Melibe.

MELIBE, Rang.

Melibe, Rang, Man. des moll., 1829, p. 129. pl. iii., fig. 3.

Melibe, R. R. Bergh, Malacolog. Unters. i. (Heft 9, 1875), pp. 382–386, taf. xlv.–xlviii.; iii. (Heft 17, 1890), pp. 881–883

Melibe, R. R. Bergh, Beitr. z. Kenntn. d. Japan. Nudibr., i. Verh. d. k. k. zool. bot. Ges. in Wien, xxx., 1880, pp. 160–165; taf. ii., figs. i.–ii.; taf. iii., figs. 1–2.

Melibe, R. R. Bergh, Beitr. z. Kenntn. d. Æolidiaden., *l.c.*, xxxviii., 1883, pp. 688–693; taf. xvii., figs. 13–14; taf. xix., figs. 3–7.

Melibe, R. R. Bergh, Beitr. z. Kenntn. d. Gattung Melibe, Rang. Ztschr. f. wissensch. Zool., xli., 1884, pp. 142–152, taf. iii.

Melibe, R. R. Bergh, Gasteropoda opisthobranchiata. Dan. exped. to Siam (Danske Vidensk. Selsk. Skr., xii., 2), 1902, pp. 42–45 (205–209). pl. iii., figs. 6–10.

Chiorœra, Gould. Un. St. Explor. exped. Moll., 1852, p. 309, fig. 404.

Corpus nonnihil compressum. Branchiæ (propriæ) nullæ. Podarium angustius.

Bulbus pharyngeus solum lingua destitutus.

These animals, which in some parts of the seas very likely are to be found as frequent as Tethys in the Mediterranean, belong only to the warmer and tropic seas. Continued examination will likely reduce the number of the mentioned species, which are as follows:—

1. *M. rosea*, Rang.
   Mare Capense.
2. *M. Rangii*, B.
   M. rubr.
3. *M. fimbriata*, A. et H.*
   M. Indic.
4. *M. ocellata*, B.
   M. Indic.

* Eliot, On some Nudibranchs from Zanzibar, *l.c.*, 1902, pp. 68–70, fig. 5.

5. *M. vexillifera*, B.
   M. Japon.
6. *M. papillosa* (de Filippi).
   M. Japon.
7. *M. bucephala*, B.
   M. Siamense.
8. *M. capucina*, B.
   M. Philippin.
9. *M. pilosa*, Pease.
   M. Pacific.
10. *M. leonina* (Gould).
    M. Pacific.
11. *M. australis*, Angas.
    M. Pacific.

Melibe rosea, Rang.

Rang, Man.—des moll., 1829, p. 129. pl. iii., fig. 3.

Pl. IX., figs. 1–12.

At Woodstock Beach, Table Bay, 10 individuals of this form were procured, of which 2 were dissected.

They varied in length from 1·5–3·8 cm. The largest was very hardened, the cowl-shaped head quite contracted, and all the papillæ of the back fallen off. Two other specimens were 3·2 cm. long by a breadth of the body proper of 0·8 and a height of 1·2; the head 11 mm. broad and 11 mm. long on the upper side, beneath merely 3 mm. long; the stalk of the rhinophores 2 mm. high, the epinotidia of the back up to 8 mm. in height; the breadth of the foot 4, the length of the tail 6 mm. The animals were uniformly whitish; living they varied according to Prof. Gilchrist from white to yellowish red, usually the latter.

In the form of the body the animal agrees with other Melibes. The *large cowl-shaped head* with a little thickened refolded edge provided with 2–4 close-set series of cirrhi (fig. 1), which are conical, somewhat constricted at the base, up to 0·6 mm. high, but often contracted, especially the innermost; the outside of the capuchin shows under a strong lens (fig. 1*a*) very fine nodules formed of small groups of glandular cells; the thickness of the cowl up to 1 mm.; it showed the muscular bands, circular, and especially longitudinal, very distinctly shining through; the inside of the cowl quite the same as the outside; median in the bottom of its cavity somewhat beneath the centre, the roundish mouth with circular prominent lip, the diameter of the whole region 2·5 mm.;

the lip covered all over with small papillæ. Behind the middle of the length of the cowl the rhinophores, from the bottom of the chalices (with undulated margin), rise the beautiful strong club with about 12 lamellæ and terminal papilla. The even *back* with minimal nodules as the cowl; on its rounded margin in these individuals 8 epinotidia (papillæ) on each side, 4 large, 1 of middle size, and 3 small. These organs (fig. 2) were a little compressed, narrower at the root, pointed towards the end, pronounced nodulous; they adhered rather firmly to their base.* The anal aperture before the second (right) organ more inwards. The *sides of the body* even as the back. The narrow *foot* projected 2 mm. beneath the cowl, of almost the same breadth throughout the whole of its length, the tapering tail rather short.

The intestines were nowhere to be seen from without, which was, however, the case with thin muscular fibres running along the whole length of the sides of the body. The cavity of the body reaching to the region of the last of the larger papillæ.

The *central nervous system* as in other species examined (*M. capucina*).

The outer mouth (already mentioned) leading in the (about 1 mm.) long mouth tube (fig. 3*a*), on the inside, covered with small cones (fig. 4), of the same kind as on the outer lips. Both the buccal tube and the bulbus pharyngeus are wrapt in a rather closely adhering connective tissue. The length of the *bulbus pharyngeus* 1·5 mm. by a breadth of 2, on its hinder end and beneath a little prominence; through the walls the outlines of the mandibles were very distinctly visible (fig. 3*b*). The cavity of the mouth with longitudinal folds, but no trace of lingual prominence. The clear-yellow mandibles (fig. 5) resembling those of p. ex. the Tritoniæ or Pleurophyllidiæ; also partly covered by a muscular disc, about 0·65 mm. broad, with a strong connective region and a very plump denticulated masticatory edge, the 10–12 denticles reaching a height fig. 5) up to 0·08 mm.†

The white salivary glands small, uneven.

The œsophagus (figs. 6*a*, 7*a*) 6 mm. long, with rather strong longitudinal folds. The *stomach* (figs. 6*b*, 7*b*) of a diameter of 3 mm., roundish; through its anterior part shone indistinctly longi-

* The figure of Rang represents 7 pairs of papillæ, the two hinder small. The smaller papillæ were often set not in pairs, but unpaired in the middle line. The smaller individuals had often only 5 papillæ, of which the 3 larger, 2 paired or unpaired.

† The bulbus pharyngeus with its mandibles agrees very likely in the other species of Melibe in general with that of the typical species. Cf. *l.c.*, taf. xlviii., figs. 10–12.

tudinal folds; in this part opened from each side the bile-duct (figs. 6*c*, 7*cc*) and a little more backwards the intestine (figs. 6, 7). Through the posterior part of the stomach shone the belt of the *stomachal plates* (figs. 6, 7). This belt was formed of 8 brownish yellow plates of usual form with 1–3 intermedian smaller. The short *intestine* stomach-like dilated in its first part, with several small pocket-like widenings arranged in a series (fig. 6*d*) on the anterior margin, with fine oblique folds on the inside; from this widened part issues a stronger fold, which with several thinner ones runs through the length of the intestine (fig. 6*e*). The total length of the intestine 9 mm.—The contents of the alimentary cavity were animal matter with remains of small Hydroids.

The three *principal liver-branches* with their ramified hepatic ducts and the principal branchlets to the dorsal epinotidia as usual, but in these last clearer (not so yellow); the epinotidial hepatic trunks not reaching the point of the organs and their branchlets scarcely entering in the nodules; through the axis of the papillæ moreover two vessels and muscular fibres, which cause the often very notable contraction of the epinotidia. The nodules of these are again finely nodulous (fig. 8), and each of the minimal nodules possesses a few glandular cells.

The net-work of the liver-branches is interwoven with the much branched *renal tubes* (figs. 9, 10), the branches reaching the root of the epinotidia, but did not seem to ascend into them. The renal cells reaching a diameter of 0·025 mm. (fig. 11).

The large yellow lobules of the *hermaphrodite gland* filling a great part of the hinder cavity of the body, wrapped up and often concealed by connective tissue and by closely adhesive hepatic branches and lobules. They were chiefly globulous, of a diameter up to 3 mm., their number only about 20; their structure as usual.

The *anterior genital mass* large, 8·5 mm. long by a breadth of 4 and height of 5, white and yellowish. The yellow hermaphrodite duct long, twisted. The ovigerous duct did not seem to have a "fan-shaped" organ (as in the *M. capucina*). The seminal vesicle small, pear-shaped, 2 mm. in its greatest diameter; the rather strong duct somewhat winding. The globular prostata has the anterior somewhat flattened, and the navel here is deep; it is yellowish, of a diameter of 3·5 mm., finely granulated on the whole of the surface; its duct rather strong, 4 mm. long. The præputium thin, 3 mm. long; the pointed glans (fig. 12) shone through throughout its whole length. The chiefly white mucous gland formed the largest part of the anterior genital mass.

Rang had the type of his genus Melibe from the Cape seas. The original specimens do not of course now exist, and since then no Melibe has been mentioned from this region. The figure of Rang (he gives no adequate description) does not prohibit an identification with the form here examined, that henceforth very likely will adopt the name of Rang, especially if it shall be found, when living, rosy. It seems different from the *M. Rangii* of the Red Sea, and can scarcely be identified with any of the other described species.

PLEUROPHYLLIDIIDÆ.

R. Bergh, System, *l.c.*, pp. 1060–1064.

The family contains the genera Pleurophyllidia (proper) of Meckel, the Lingvella of Blainville, and Camarga of Bergh.

PLEUROPHYLLIDIA, Meckel.

R. Bergh, System, *l.c.*, pp. 1063–1064.—Die Opisthobranchiata d. Siboga Expedition, 1905, *l.c.*, pp. 213–215.

A number of species is known, chiefly from the warm and from the tropical seas.

1. Pl. capensis, B. n. sp.

Pl. VIII., figs. 23–24.

One individual was procured about 16 miles W. of East London by large trawl from a depth of 37–39 fms.

The *length* of the rather contracted and hardened animal was 5 cm. by a breadth of 3·3 and a height up to 2·5; the breadth of the dorsal brim up to 1·4 cm.; the length of the gill 1, the height of its leaves 4 mm., that of the lateral lamellæ up to 3·5 mm., the breadth of the head (tentacular shield) 2 cm.; the breadth of the foot 2·2 cm., of its brim up to 7 mm., the length of the furrow of the tail 8 mm. by a breadth of 2·5.—The ground *colour* of the back was black, but supplanted by the light yellowish longitudinal folds; the neck with the rhinophores black (with whitish point), the tentacular shield black; the gill bright-grayish, the lateral lamellæ bright dirty yellowish, the sides of the body grayish black, the foot nearly black, the tail-furrow white.

The form as a whole, the usual. No proper nuchal caruncula, the rhinophores 5 mm. high, as usual; the dorsal folds as usual, rather regularly alternating in thickness, their number at the middle of the

length of the back about 30. The lamellæ on the under side of the brim of the back numerous, especially at the thin and narrow margin; the larger ones, in number about 30, descending obliquely from the narrow margin forwards; the margin proper of the back showed no openings of cnidophore sacs. The sides low; the genital and renal opening as usual, as also the rather prominent anal papilla. The margins of the rather strong caudal furrow prominent.

The whitish *bulbus pharyngeus* 12 mm. long by a breadth and a height of 11. The yellowish *mandibles* united 10 mm. long and broad, the height of the convexity 4 mm.; their inner half much thicker than the outer; the mandibular process as also the whole of the *masticatory edge straight and quite even.* The rasp of the *tongue* yellow, containing about 25 series of teeth, in the sheath moreover about 33 series, the total number being thus 58. In the lateral series about 50 plates. The plates were yellow and yellowish; the breadth of the median plates 0·30 mm., the height of the first lateral 0·08, of the fifth 0·28, and this height was scarcely surpassed. The *median plates* broad (fig. 23), with short hook and on each side *about* 10 *denticles;* the lateral plates also of usual form, mostly with 4–6 very small denticles (fig. 24), the outermost mostly without these.

The upper salivary glands (gl. salivales) as usual; the under (gl. ptyalinæ) very strong.

The œsophagus and the stomach as usual; the intestine 3 cm. long by a diameter of 2–2·5 mm., in the rectum some dark animal matter. The liver ramifications in the lateral laminæ as usual. No cnidocysts could be found; but in the narrow margin of the back fine gland-openings.

The large hermaphrodite gland dirty brown, 18 mm. long by a breadth of 12 and a height of 10; the ampulla of the hermaphrodite duct brown. The large anterior genital mass white and whitish, 15 mm. long by a height of 8 and a breadth of 7 mm.; the seminal vesicle large.

This species seems different from others known from the coast of Africa, from the *Pl. natalensis*, B., *Pl. Petersi*, B., and perhaps from the *Pl. Horatii* of Eliot.* The mandibles have a straight, even masticatory edge, the lateral plates of the rasp have mostly

* Eliot, "On some Nudibranchs from East Africa and Zanzibar," ii. Proc. Zool. Soc. of London, 1903, i., pp. 251–252.

The description of this species (given by Crossland) is not at all clear; the assertion of Eliot that the gill is wanting is very doubtful; the median plates have a long cusp, and the cnidocysts are distinct.

some few denticles, the nuchal region is even (and the margin of the back without cnidocysts).

2. Pl. Gilchristi, B. n. sp.

Pl. VIII., figs. 14–18.

Of this form one individual was procured off Sebastian Bluff (July 11, 1900) from a depth of 40 fms. by shrimp-trawl, two off Cape St. Blaize from muddy bottom and a depth of 35 fms. by large trawl, and one more off Cape Point Lighthouse.

The three last had a length of 20 and 27 mm. The first, which was thoroughly examined, was 24 mm. long by a breadth of 15 and a height of 8 mm., the tentacular shield 9 mm. broad; the brim of the back mostly 4·5 mm. broad, the length of the gill 4·5; the breadth of the foot 12, the length of the (not very pronounced) furrow of the tail 4 mm.—The ground colour of the back grayish, more blackish in front, the folds whitish, otherwise the animal seemed to be uniformly white.

The lateral lamellæ as above, in number about 40, about half of which were larger; no cnidal pores or bags were seen. The neck without caruncle, folds, or papillæ.

The anal papilla formed a prominence 5 mm. in height.

The central nervous system as usual. The otocysts 0·06 mm. in diameter.

The *bulbus pharyngeus* 3·5–4 mm. long by a breadth and a height of 2·5. The *mandibles* of a length of 3 mm. by a breadth of 2·8, their masticatory edge yellow, elsewhere nearly colourless; the *masticatory margin* (fig. 14) with (about 10) series of very small *blunt cones* of a height of about 0·025 mm. (in two individuals). The very bright yellowish rasp of the *tongue* contained, in the two individuals examined, 22 and 25 series of plates, in the sheath moreover were counted 23 and 21, the total number of series being thus 45–46. In the lateral series (of three individuals) 41, 33, and 35 plates. The plates rather pale; the breadth of the median 0·17–0·18 mm., the height of the first lateral 0·12, of the next 0·16, rising to 0·18, that of the outermost about 0·10 mm. The *median plates* had 4 *strong denticles* on each side (fig. 15), the first lateral with (fig. 16) 6–8 not quite small denticles, the plates of about the inner third or eighth part of the rasp provided with a few very fine denticles (fig. 16), the rest without denticle (fig. 17).

This form is different from the preceding and does not seem to agree with any one of the hitherto known species.

3. Pl. euchroa, B. n. sp.

Pl. VII., figs. 1–5; Pl. VIII., fig. 25.

Two specimens of the form were procured, both by shrimp-trawl; one taken from a depth of 50 fms. (green mud) off Cape Hang Klip; the other from sandy bottom at a depth of 30 fms. in Buffalo Bay. A third individual was dredged off Cape Point Lighthouse, and two at Seal Island from a depth of 16 fms. and a sandy bottom with shells.

The first two were about of the same size and appearance. Their length was 17 mm. by a breadth of 9–10 and a height of 6–7; the breadth of the frontal veil 5, of the brim of the back 4 mm., the length of the gill 2 by a breadth of 1·75 mm., the breadth of the foot 7 mm., of the caudal furrow 3–4 mm. The two last-mentioned individuals were 3 cm. long (not dissected).—The ground colour of the back dark gray or blackish with whitish lines, the colour otherwise whitish or yellowish.

Of the usual form, behind the frontal veil perhaps a small caruncle; the margin of the back with a series of fine sometimes grayish cnidocysts, their contents sometimes projecting. The lateral lamellæ obliquely set, in number about 40.

The *bulbus pharyngeus* in 4 individuals whitish, 3–3·5–4 mm. long by a breadth of 3–3·5 and a height of 3. The mandibles thin, yellowish, about as in *Pl. Gilchristi*, the height of the columns of the masticatory edge about 0·04 mm., of which the blunt end projected 0·01 mm. high. The nearly colourless or dirty yellowish rasp of the *tongue* contained 18 rows of plates, in the sheath 27, the total number of series being thus 45; in the series on each side about 25 plates. The plates yellowish; the breadth of the median 0·14 mm.; the height of the two outermost lateral 0·06–0·08 mm., rising to 0·20. The median plate (fig. 25) had on each side 5 strong denticles and a small one on the short pointed hook; the first lateral plate with a series of fine denticles (fig. 1), all the other (figs. 2, 3) without denticles (as in the *Pl. natalensis*).

The cnidæ as usual. The anterior genital mass dirty yellowish, of meniscus form. In three individuals the pointed penis (fig. 5) projected 5·5 mm. from the genital papilla or everted vestibulum (fig. 4).

To the same species very probably belong a large individual procured by large shrimp-trawl about 20 miles W. of East London from a depth of 37 fms.

It had a length of 4·5 cm. by a breadth of 1·8 and a height of 1;

the tentacular veil 10 mm. broad; the breadth of the foot in front (with its angles) 20 mm.; the length and the breadth of the gill 5 mm.—The ground colour of the back black, but the colour reduced by the white longitudinal ribs (in number at the foremost third about 25); the colour otherwise whitish.

The foremost lamellæ horizontal, the rest obliquely set as usual: on the brim of the back very pronounced cnidocysts. The caudal furrow very pronounced, yellow, 13 mm. long by a breadth of 1·25.

The *bulbus pharyngeus* (projecting freely 8 mm.) whitish, 9 mm. long by a height and a breadth of 6. The mandibles yellow, rather strong; the masticatory edge had about 15 series of scarcely prominent roundish quadrangular facets of a diameter up to 0·025 mm., belonging to columns of a height up to 0·04. In the yellowish rasp of the *tongue* 22 series of plates, in the sheath 34, the total number of rows thus being 56; the number of plates in the series seemed to rise to 32. The median teeth 0·29 mm. broad, their hook with a little denticle on each side, more outwardly 6–7 coarser denticles on each side. The lateral plates quite as above, reaching a height of 0·30 mm.

This form seems specifically different from the foregoing. Of the hitherto known species of Pleurophyllidiidæ only *Pl. natalensis*, *cygnea*,* and *Mülleri*† show the margin of the lateral plates (with the exception of the first always finely denticulated) even (not denticulated), but from these species *Pl. euchroa* seems to differ by different character of the masticatory edge of the mandibles.

4. Pl. microdonta, B. n. sp.

Pl. VIII., figs. 17–22.

Off Constable Hill (NNE. 6½ miles) one specimen was taken by large trawl from a depth of 33 fms. and green mud bottom. It was in a very bad state of preservation, very hardened, somewhat contracted and bent.

The length seemed to have been 3 cm. by a breadth of 1·5 and a height of 1. The ground colour of the back seemed to have been black, the whitish lines as usual.

A caruncle before the rhinophores could not be detected. The gill, the lateral lamellæ, and the cnidocysts as usual.

The length of the *bulbus pharyngeus* 4 mm. by a breadth of 3·5

* R. Bergh, "Neue Beitr. zur Kenntn. d. Pleurophyllidien." Malacozool. Bl., xxiii., 1876, pp. 9–13; taf. 1, figs. 1–7.

† H. v. Jhering, "Zur Kenntniss d. Nudibranchien der brasilianischen küste." Malakol. Jahrb., xiii., 1883, pp. 223–228; taf. 9, fig. 1.

and a height of 3. The yellow mandibles as in the *Pl. euchroa.* The rasp of the *tongue*, clear yellow, seemed to contain 20 series of plates, the sheath about a like number; in the lateral series about 50 plates. The plates yellowish; the breadth of the median 0·075 mm. by a height of 0·05, the height of the thin outermost lateral 0·055. The median plates (figs. 19, 20) with 8–10 denticles on each side of the pointed hook, which had a strong denticle at its root. The lateral plates of common form, with mostly 8–10 pointed denticles (fig. 22), the 10–15 outermost somewhat slender, without denticles.

This form differs from the other, particularly in the very small size of the plates of the rasp.

PECTINIBRANCHIATA.

MARSENIIDÆ.

R. Bergh, Malacolog. Untersuch., iv. (Supplementheft iii., 1, 2), 1886–1887, with 14 plates.

MARSENIA, Leach.

1. Mars. perspicua (L.).

Pl. XIV., figs. 5–9.

A specimen was sent, taken off Umhlanga River mouth by shrimp-trawl. It was somewhat contracted, nearly semiglobular. Later five specimens were fished at Cape Point (N. 50° E., 18½ miles), among which was one male. The largest was 3·3 cm. long by a height of 1·5 and a breadth of 2·7 cm.

The length of the first mentioned, male, specimen was 12 mm. by a breadth of 8 and a height of 5.

The colour of the smooth back was gray with rather numerous more or less large blackish spots; the rest of the body yellowish. The inside of the mantle spotted blackish. The *shell* of usual form, 8 mm. long by a breadth of 6, thin and very fragile.

The form of the body quite as in the typical Marsenia. The large penis projected forwards, 6 mm. long.

The buccal tube 2 mm. long. The *bulbus pharyngeus* 2 mm. long, its form quite as usual, the long rasp-sheath rolled up to the right

side. The mandibles 1·5 mm. long, yellow in the anterior part, otherwise nearly colourless (fig. 5), the hinge very pronounced (figs. 5, 6). The *tongue* as usual; the yellow rasp of a breadth of 0·37 mm., containing 12 series of plates; in the sheath moreover 35, of which the 3 hindermost were not quite developed; thus the total number of series 47. The plates very clear yellowish; the breadth of the median plates behind 0·10 mm.; the length of the lateral ones in a straight line 0·22. The median plates (fig. 7*aa*) of usual form; the anterior refolded edge with 2 (–3) denticles on each side of the pointed hook, the legs not quite of the same length. The lateral plates (fig. 7) also of usual form; the pointed hook (fig. 8) showed at the upper edge 12–15 denticles, of which the hindermost 4–5 were much stronger; the lower edge had 4–5 rather weak and blunter denticles.

The œsophagus as usual with a widening. The liver brown.

The *penis* of about the common form, somewhat compressed; from its end the very pointed continuation of the vas deferens projected (fig. 9).

The *larvæ of the Marseniæ*, the Echinospira, &c., are found widely spread in plankton and carried far and wide by the currents. By far the most of the forms of Marsenia described as species, including this form, are probably only local varieties of the *Mars. perspicua*, which seems to be almost cosmopolitan; I have seen such forms collected by Plate on the western coast of South America ("Die Opisthobranchien der Sammlung Plate," Zool. Jahrb., Supplementheft iv., 3, 1898, pp. 564–569), and others collected by Mortensen near the coast of Siam ("The Danish Expedition to Siam," 1. Gasteropoda opisthobranchiata, 1902, pp. 213 (55) –214 (56); pl. iii., figs. 13–14).

2. Marsenia capensis, Bgh. n. sp.

Pl. IX., figs. 13–16.

Ten individuals of this form (four of which were male) were procured at Cape Point with shrimp-trawl from green mud and a depth of 650–700 fms.; one more at Cape Point by American trawl from a depth of 310 fms. with bottom of sand and black specks; moreover from the same locality 13 specimens from a depth of 700–800 fms. with green mud bottom (6 of 8 examined were male). Three rather large (2·8 (♀) and 3·5 (♂) and 4 (♂) cm. long) were moreover caught off Lion's Head from a depth of 131, 136, 195, 204 fms.

They were all very contracted and stiff.

The length of the dissected individuals varied from 14–18 mm.

the two largest had a breadth of 16 and a height of 8 mm. They were uniformly coloured whitish; on the back rather spread short 0·5 mm. high conical prominences; the shell shone white through the mantle, but always (on account of the strong contraction) broken in pieces. The form of the animal as usual; so too, as far as could be determined, the thin *shell*.

The *bulbus pharyngeus* of usual form, 6 mm. long; the rasp-sheath in two of the three more closely examined (female) individuals rolled up to the right, in the third (male) to the left side. The mandibular plates, 2·5 mm. long, of about the usual form, but the brownish masticatory part not separated by an actual furrow from the yellowish remainder; the anterior narrower margin (in the three individuals) produced in a strong point (fig. 13). On the yellowish rasp 16–17–20 series of plates, in the sheath 25–40–42, the total number of rows being thus 41–57–62; the end of the sheath very little swollen, rounded behind. The thicker part of the lateral plates yellow; the rest as well as the median plates nearly colourless. The breadth of the median plates 0·25 mm., the length of the lateral 0·52. The median plates with curved anterior margin with pointed hook and with about 10 fine denticles on its sides, the posterior margin straight (not bifid) (figs. 14, 15). The lateral plates of usual form, the upper margin of the hook with 8–20 fine denticles, the other with 6–8 coarser.

The liver grayish brown. The large ovarium yellow. The *penis* (fig. 16) 7 mm. long, somewhat flattened, always (by 10 individuals) of quite the same form.

The largest (male) individual 4 cm. long by a breadth of 3·3 and a height of 2; when living it was white; the back was somewhat nodulous; the penis quite as described. The shell very thin, broken.

The *bulbus pharyngeus* 7 mm. long, the rasp-sheath rolled up to the right. The mandibles nearly as above. In the rasp 17 series of plates, in the sheath 49, the total number of rows being thus 66; the plates quite as above.

3. Marsenia leptoconcha, B. n. sp.

Pl. IX., figs. 17–20; Pl. X., figs. 1–2.

One male specimen was procured off Cape Point (E. ½, N. 36 miles) from a depth of 700–800 fms. from green mud bottom by shrimp-trawl.

The specimen resembled, preserved in formalin, a somewhat

transparent sphere, flattened on the under side. The length was 6·8 cm. by a breadth of 5·5 and a height of 4; the submedian (inspiratory) cleft 1 cm. long; the breadth of the mantle brim, that was bent downwards and touching the margin of the foot, 13 mm.; the aperture of the gill cavity 9 mm. broad; the length of the tentacles 8 mm., that of the penis 2·6 cm. by a diameter of 0·5; the length of the foot 4 cm. by a breadth of 2·2; the length of the tail 12 mm.—The upper side of the mantle uniformly coloured greenish white, the under side of the mantle (except the broad inspiratory furrow), the neck, and the upper side of the foot velvet black; the tentacles, the penis, and the sole of the foot white; the intestines did not shine through.

The *mantle* was even all over; its under side densely transversely striated, no distinct expiratory furrow. The ophthalmophoria very small, and eyes not visible. The penis strong, nearly cylindrical. The foot as usual.

The *shell* 3 cm. long by a breadth of 2, as in the *Mars. leptolemma* quite thin, membranous, slightly yellowish, easily loosened from the intestines, and when spread in water assuming the ordinary form of the Marsenia shell (fig. 1).

The situation of the intestines quite as usual. The olfactory organ (Spengel) 15 mm. long by a breadth of 9, dirty brown with whitish rhachis; the curved gill whitish, about 2·5 cm. long, its very thin and narrow leaves up to 8 mm. high. The ventricle of the heart 5 mm. long; the kidney and the foliated gland exhibited the usual relations and structure.

The *bulbus pharyngeus* of usual form, but small, 6 mm. long by a breadth of 6 and a height of 3·5, whitish. I did not succeed in determining the form of the mandibular plates. The *tongue* as usual; in the faintly yellowish rasp 22 series of plates, in the sheath (that was bent directly forwards and median, reaching to the anterior of the bulbus) 46, the total number of the series thus being 68. The median plates quite colourless, the breadth between their legs 0·22 mm. The median plates narrower in front, with 4–6 sharp denticles on each side of the pointed hook (fig. 18); the lateral plates of the common form on one margin unusually finely denticulated, on the other with 4–6 more clumsy (fig. 2) denticles. The end of the rasp-sheath smaller than usual (fig. 19).

The œsophagus as usual and with a widening. On the anterior side of the *psalterium* (the foliated or glandular stomach) the transversely situated second stomach or crop. The psalterium itself semiglobular, somewhat of a cup-like shape, of a transverse diameter of 9 mm., yellowish. The proper (third) stomach as usual. The

brownish *liver* for the most part covered by the yellowish *testis*, whose large lobes contained ripe zoosperms. The vas deferens formed the usual twisted ball, and was continued forwards first in a straight course; it continued in winding through the penis, and projected a little from its end (fig. 20).

Another, a female and somewhat smaller, specimen was procured off Cape Point (NE. by E. 36 miles), 660–700 fms., green mud.

It was 3·5 cm. long by a breadth of 2·3 and a height of 2·8 cm. The colour was quite as in the male individual, as were also the ophthalmophores. The exserted pharyngeal bulb was (only) examined.

The *bulbus pharyngeus* 6 mm. long by a breadth of 5. The mandibles 3 mm. long, dirty yellowish, in the anterior part dirty brownish, of about the usual form (fig. 17). The rasp of the *tongue* more yellow than in the male specimen, containing 23 series of plates; the sheath bent upwards and forwards in the median line, but not reaching so far forwards, containing 26 series, of which the 5 hindermost were not fully developed; the total number of series thus 49. The plates quite as in the other specimen.

As regards the large size and the membranous condition of the shell this form quite agrees with *M. leptolemma* of the Atlantic.* The colour of the under side of the mantle is, however, quite different, as also the character of the lingual plates, especially that of the median. This form is a new species.

NATICIDÆ.

SIGARETUS, Lmk.

Sigaretus planulatus, Recluz.

Sigaretus planus, Philippi. Abb. u. Beschreib., i., 1842, p. 146; tab. i., fig. 7.

Sigaretus planulatus, Recluz. Sigaretus, Chenu, illustr. conchyl., 1843–1845.

Sigaretus planus, Phil. Troschel, das Gebiss d. Schnecken, i., (1856–) 1863, p. 184; tab. xv., fig. 16.

* R. Bergh, "Nudibranches et Marsenia," Res. scientif., par Albert i., fasc. xiv., 1899, pp. 31–36; pl. i.; pl. ii., figs. 1–5.

Sigaretus planulatus, Recluz. Sowerby, Thesaurus, v., 1887, p. 42. No. 14, tab. 442, figs. 29–30.

Pl. X., figs. 4–16.

Two specimens were dredged off Umvote River from a depth of 27 fms. from sandy bottom with shells. They were of quite the same size, now very hardened and very difficult to examine; in the male individual the shell was well preserved, in the female broken in pieces.

The colour was dirty yellowish gray. The length 4 cm., of which the propodium measured 1·7; the breadth of the propodium behind 13 mm., at the anterior narrower.

The milk-white fine *shell* on the middle of the animal 16 mm. long by a breadth of 11 and a height of 5, with a very thin yellowish cuticle. An operculum was not present.

The propodium broader behind, sloping towards the rounded anterior end, flat and even; its straight hinder brim covering the head and the margin of the gill cavity; the propodium is separated by a furrow from the sole; behind this furrow passes in the flatter furrow at the margin of the tail. The hinder foot, the tail is gradually pointed backwards and sloping, rather convex, even, along the margin accompanied by a furrow; its anterior end concave, thinner, and with a height up to 13 mm., reflected on the shell, whose hinder end partly covers its outer lip.

The broad, short *head* (fig. 4) with rather (4 mm.) long tentacles; the intestines shone blackish through the floor of the gill cavity. The nearly cylindrical *penis* (fig. 7) 15 mm. long by a diameter of 1–1·5, with a hollow at the end, from the end of which the sperm-duct projected; along the side a superficial furrow. The clear yellow gill (fig. 5) 13 mm. long with a breadth up to 3·25; its fine leaves (fig. 6) free for about half their length. The olfactory organ (Spengel) dirty brownish, nearly as long as the gill by a breadth of 1·25 mm., bent in its anterior end.

The brownish gray *bulbus pharyngeus* of oval form, nearly 2 mm. long. The mandibles nearly reaching each other above and below; brownish yellow, 0·75 mm. long by a breadth of 0·5; their elements as in other Sigareti, 0·10 mm. long (fig. 8). The very faint yellowish rasp of the *tongue* containing about 30–36 series of plates; the long sheath (fig. 16) of a breadth of 0·20 mm., bent several times, affixed to the œsophagus and the salivary glands, contained a much larger number; the number of rows seemed in the two individuals to be all in all 131 and 145 (♂). The plates nearly colourless; the breadth of the median 0·13 mm., the height of the lateral plate 0·11, of the

two outer plates 0·115 mm. The median plate (figs. 9*a*, 10–12) broad, in front a little concave and narrower, behind a little convex and with the angles prominent and pointed; the cutting edge with a small median tooth with a stronger one on each side, from the under side a short pointed hook moreover projected (figs. 10–12). The lateral plate upwards bifurcate, the anterior part longer than the posterior (figs. 9*b*, 13).* The outer plates (figs. 14, 15) hook-shaped, the interior a little stronger than the exterior, both a little blunt at the point, the interior (fig. 14*a*) with 3 small teeth, the exterior with but one (fig. 14*b*).

The state of preservation did not admit of an examination of the other organs.

* The figure by Troschel (*l.c.*, p. 185; taf. xv., fig. 16) of the lateral plate seems rather different, but is very likely but incorrectly drawn. It is not quite easy to get the different plates arranged in a convenient position.

Troschel saw in his two individuals 126 and 134 series of plates, and the median plates of a breadth of 0·15 mm.

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Doriopsilla capensis, B. 64
Doriopsis cæsia, B. 62
,, callosa, B. 61
,, capensis, B. 60
,, sp. 63
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,, ,, (?) perplexa, B. 53
,, ,, (?) pseudida, B. 52

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Tritonia indecora, B. 85
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,, perspicua (L.) 104
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After the printing of a large part of this memoir I received the

"Notes on some British Nudibranchs" (Journ. of the Marine Biological Association, vii., 3, 1906, pp. 333–382, with 2 pl.), by Sir Charles Eliot,

and

"Opisthobranchiate Mollusca from Monterey Bay, California, and Vicinity" (Bull. of the Bureau of Fisheries, xxv., 1905, pp. 111–151, with 14 pl.), by Prof. MacFarland.

I therefore have not been able here to use the general and special notices contained in these papers.

SYNOPSIS OF GENERA AND SPECIES.

Tectibranchiata.

Anaspidea.

Aplysiidæ propriæ.

Aplysia Gilchristi, B.
,, allochroa, B.
,, gargantua, B.
,, lobata, B.
,, eusiphonata, B.
,, poikilia, B.
,, Woodii, B.
,, monochroa, B.

Dolabella, Lam.
,, Rumphii, (Cuv.) Rang. var.

Notarchidæ.

Aclesia cirrhifera, Q. et G. var.

Cephalaspidea.

Philinidæ.

Philine aperta, L.
,, capensis, B.

Doridiidæ.

Doridium capense, B.

Notaspidea.

Pleurobranchidæ.

Pleurobranchæa, Leue.

Pleurobranchæa capensis, Vayss.
,, melanopus, B.

Oscaniopsis, Bgh.

Oscaniopsis pleurobranchæana, B.

Oscaniella, B.

Oscaniella nigropunctata, B.

Berthella, Blv.

Berthella granulata (Krauss).

Nudibranchiata holohepatica.

Doridídæ cryptobranchiatæ.

Archidoris, B.

Archidoris capensis, B.
,, granosa, B.
,, ? scripta, B.

Staurodoris, B.
verrucosa (Cuv.).
Geitodoris, B.
G. capensis, B.
Diaulula, B.
D. capensis, B.
D. ? morosa, B.
Thordisa, B.
Th. punctilifera, B.
Genus ?
Doris pseudida, B.
Genus ?
Doris perplexa, B.
Genus ?
Doris glabella, B.
Chromodoris, A. et H.
Chrom. albolimbata, B.
Chrom. euelpis, B.
Chrom., sp.
Aphelodoris, B.
Aph. ? brunnea, B.

Porostomata.
Doriopsididæ.
Doriopsis (Pease), Bgh.
Dor. capensis, B
Dor. callosa, B.
Dor. cæsia, B.
Dor., sp.
Doriopsilla, B.
Dor. capensis, B.

Doridida phanerobranchiatæ.
Polyceridæ.
Triopa, Johnst.
Tr. lucida, Stimpson.
Nembrotha, B.
N. capensis, B.
Euplocamus, Phil.
E. croceus, Ph., var. capensis.
Kalinga, Ald. et Hanc.
K. ornata, A. et H.
Goniodorididæ.
Idalia, Leuck.
Idaliella amœnula, B.

Nudibranchiata kladohepatica.
Tritoniidæ.
Tritonia, Cuv.
Tr. pallida, Stimpson.
Tr. indecora, B.
Tritonidoxa, B.
Tr. capensis, B.
Aeolidiidæ.
Glaucus atlanticus, F.
Janolus capensis, B.

Tethymelibidæ.
Melibe rosea, Rang.
Pleurophyllidiidæ.
Pleurophyllidia, Meckel.
Pl. capensis, B.
Pl. Gilchristi, B.
Pl. euchroa, B.
Pl. microdonta, B.

Pectinibranchiata.
Marsenia, Leach.
M. perspicua (L.).
M. capensis, B.
M. leptoconcha, B.
Sigaretus planulatus, Recluz.

EXPLANATION OF PLATES.

Plate I.

Aplysia Gilchristi, B.

FIG.

1. Median plate.
2. Outer end of two series of plates. *aa*, outermost plate.
   (Figs. 1–2 drawn by Cam. luc. 200 ×.)
3. A lateral plate. 350 ×.

Aplysia allochroa, B.

4. The shell, from above. 3/1.
5. Elements of mandible plate. 350 ×.
6. Median plates.
7. First lateral plate.
8. Outer end of two series. *aa*, outermost plate.
   (Figs. 6–8 drawn by Cam. 200 ×.)
9. One of the smaller stomachal plates.
10. Penis. *a*, prostata.

Aplysia gargantua, B.

11. The shell, from beneath. 3/1.
12. Elements of mandibular plate.
13. Hooks of the palate.
14. A lateral plate.
15. Outer end of a series of plates. *a*, outermost plate.
    (Figs. 12–15 drawn by Cam. 200 ×.)
16. One of the inner lateral plates. 350 ×.
17. *a*, Before the cardia region of the masticatory stomach; *b*, facets for masticatory plates.
18. A thorn from the region *a* in Fig. 17.
19. Penis. *a*, region of the glans; *b*, præputium.
20. Hinder end of the præputium opened, the glans exposed.
21. Transverse section of the head of the glans.

Aplysia monochroa, B.

22. The mantle shield.
23. Elements of the mandibles. 350 ×.
24. Hooks of the palate.

1
2
a
a
3
4
5
6
7
8
a
a
9
10
a
11
12
13
14
15
a
16
17
a
b
18
19
a
b
20
21
22
23
24

Plate II.

Aplysia gargantua, B.

FIG

1. *a*, Œsophagus; *b*, first stomach; *c*, masticatory stomach; *d*, third stomach; *e*, intestine.

Aplysia monochroa, B.

2. The shell from beneath. 2/1.
3. The penis with *a*, the prostata (?).
4. Median plates.
5. First lateral plate.
6. Outer end of a series. *a*, outermost plate.
7. Outer end of two series. *aa*, outermost plate.
   (Figs. 4–7 drawn by Cam. 200 ×.)

Aplysia lobata, B.

8. The shell, from beneath. 2/1.
9. Elements of the mandible.
10. Median and first lateral plate.
11. Outer end of a series. *a*, outermost plate.
    (Figs. 10–12 drawn by Cam. 200 ×.)
12. The penis.

Aplysia Woodii, B

13. The hinder end of the sole of the foot.
14. The shell from beneath. 3/1.
15. Elements of mandible.
16. Median plate.
17. A lateral plate.
18. The ninth plate from the outer end of a series.
19. Outer end of a series. *a*, outermost plate.
    (Figs. 15–19 drawn by Cam. 350 ×.)

Aplysia poikilia, B.

20. Elements of mandible.
21. Hooks of the palate.
    (Figs. 20–21 drawn by Cam. 350 ×.)

2
1
a
b
c
d
e
6
a
7
a
a
3
a
5
9
10
11
a
4
18
19
a
12
14
8
20
16
17
15
13
21

Plate III.

Aplysia poikilia, B.

FIG.

1. The shell from beneath. 2/1.
2. Median plate.
3. Fifth lateral plate, from within.
4. A lateral plate.

Aplysia eusiphonata, B.

5. The mantle shield, from above, with sipho.
6. The same, from the right side.
7. Elements from the mandible.
8. Hooks of the palate.
9. Median plates of two series.
10. One of the interior lateral plates.

11 and 12. Largest lateral plates.

13. Outer end of a series of plates. *a*, outermost.
(Figs. 2–13 drawn by Cam. 200 ×.)
14. Stomachal plates. 55 ×.
15. Penis.

Aclesia cirrhifera, Q. et G.

16. Mantle region. *a*, rudiment of mantle; *b*, branchia; *c*, anus.
17. Mandible.
18. Elements of mandible. 350 ×.
19. Piece of the palate plate. 350 ×.
20. Anterior end of the bulbus pharyngeus with the rasp.
21. Median and first lateral plates. 350 ×.
22. The penis.
23. The glans.
24. Hook of the penis. 350 ×.

3
1
2
9
4
7
5
11
8
12
23
18
10
6
13
15
a
19
14
17
24
16
a
22
20
21
c
b

Plate IV.

Aclesia cirrhifera, Q. et G.

FIG.

1. Upper margin of the gill (rhachis).
2. *a*, Hermaphrodite duct; *b*, anterior genital mass; *c*, spermatocysta; *d*, sperm-oviduct; *e*, spermatotheca; *f*, vulva.
3. From the interior part of the rasp.
4. One of the plates.

(Figs. 3–4 with Cam. 200 ×.)

5. Lateral plate.
6. Lateral plate.
7. Three outermost plates.

(Figs. 5–7 drawn by Cam. 350 ×.)

Pleurobranchæa capensis, B.

8. Piece of the mandible, from the side.
9. Piece from the surface.

(Figs. 8–9 with Cam. 350 ×.)

10 and 11. Plates of the rasp in different positions. 200 ×.

Pleurobranchæa melanopus, B.

12. Elements of the mandible, from the side. 200 ×.
13. Piece of the mandible, from the surface.
14 and 15. Plates of the rasp, in different positions.

(Figs. 13–15 by Cam. 350 ×.)

Oscaniopsis pleurobranchæana, B.

16. Part of the frontal margin.
17. Part of the mandibles. 350 ×.
18 and 19. Largest plates of the rasp.
20. Outer end of a series of plates. *a*, outermost.

(Figs. 18–20 with Cam. 200 ×.)

21. Salivary glands with ducts.

Oscaniella nigropunctata, B. var.

22. Element of the mandible.
23. Innermost plates.
24. Plates from the inner half of the rasp.
25. Plates from the outer half of the rasp.
26. Outer part of a series of plates. *a*, outermost.

(Figs. 22–26 drawn by Cam. 350 ×.)

Berthella granulata, Krauss.

27. Shell from the upper side. 5/1.
28. Piece of mandible. 350 ×.

4
a
b
c
2
e
1
f
3
8
6
5
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11
13
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12
14
15
21
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a
17
16
18
19
22
25
23
27
28
24
26
a

Plate V.

Berthella granulata (Krauss).

FIG.
1. Point of elements of mandible.
2. Element from the side.
3. Plate of the rasp.
4. One of the largest plates.
   (Figs. 1–4 by Cam. 350 ×.)

Philine aperta (L.).

5. Salivary gland.
6. A plate of the rasp.
7. Upper half of a plate.
   (Figs. 6–7 by Cam. 200 ×.)
8. Piece of the denticulation of the hook. 350 ×.)
9. The penis apparatus. *a*, a prostatic gland; *b*, globular sac with duct; *c*, cylindrical sac; *d*, præputium; *e*, hammer-shaped glans.
10. The freely projecting hammer-shaped glans. *a*, end of prostatic gland.

Philine capensis, B.

11. The shell.
12. A lateral plate of the rasp.
13. The innermost of the two outermost plates.
14. The outermost.
    (Figs. 12–14 drawn by Cam. 350 ×.)
15. A stomachal plate from the inside. 20/1.

Archidoris granosa, B.

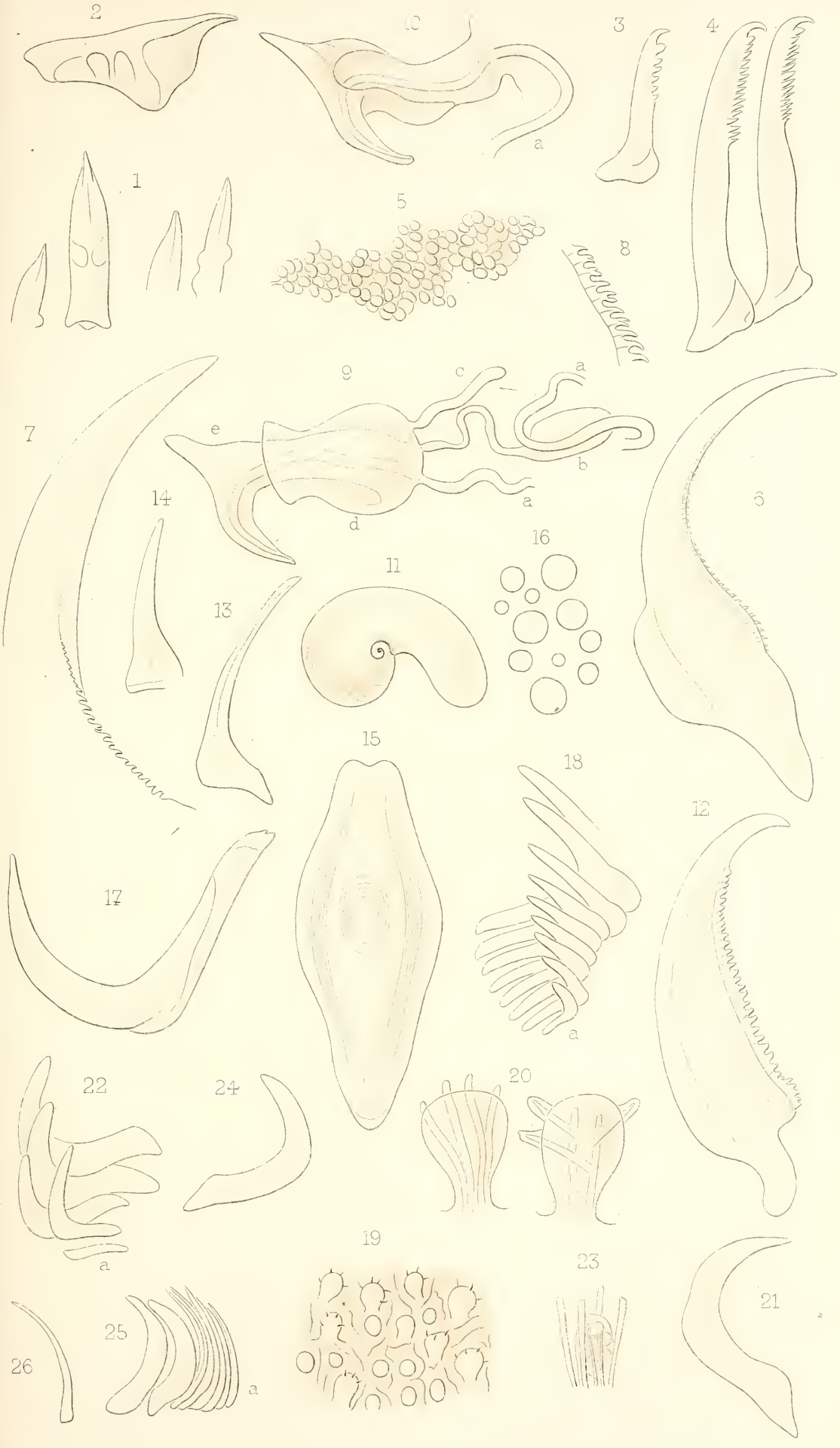
16. Nodules of the back.
17. A plate of the rasp.
18. Outer end of a series of plates. *a*, outermost.

Diaulula capensis, B.

19. A piece of the skin of the back. 55 ×.
20. Tubercles of the same.
21. A plate of the rasp.
22. Outer end of a series of plates. *a*, outermost.
    (Figs. 21–22 by Cam. 200 ×.)

Diaulula ? ? morosa, B.

23. A tubercle of the back.
24. A plate of the rasp.
25. Outer end of a series of plates. *a*, outermost.
26. One of the outer plates.
    (Figs. 24–26 with Cam. 350 ×.)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a

Plate VI.

Thordisa punctulifera, B.

FIG.
1. Piece of the skin of the back.
2. A tubercle of the same.
3. Of the rhachidian part of the rasp.
4. Outer part of two series of plates. *aa*, outermost.
(Figs. 2–4 by Cam. 350 ×.)

Doris perplexa, B.

5. A plate of the rasp. 200 ×.
6. Outer end of a series of plates. *a*, outermost. 350 ×.

Doris pseudida, B.

7. A plate of the rasp. 200 ×.
8. Outer end of a series of plates. *a*, outermost. 350 ×.

Doris glabella, B.

9. Part of the gill.
10. Part of the armature of the lip-disc.
11. Inner part of a series of plates. *a*, innermost.
12. A plate of the rasp.
13. Part of two series of plates, each with a deformed plate.
(Figs. 10–13 by Cam. 350 ×.)

Chromodoris euelpis, B.

14. Elements of the lip-disc. 750 ×.
15. Plates of the rasp. 350 ×.
16. One of the largest plates.
17. An outermost plate.
(Figs. 16–17 with Cam. 350 ×.)

Chromodoris albolimbata, B.

18. A gill-leaf. 55 ×.
19. The bulbus pharyngeus, from the under side, with lip plates.
20. Elements of the lip disc.
21. Part of the middle of the rasp. *aa*, pseudo-plates.
22. Innermost plates of the rasp.
23. One of the largest plates.
24. Outer end of a series of plates. *a*, outermost.

Chromodoris, sp.

25. Elements of the lip disc.
26. Plates of the rasp.
(Figs. 19–26 by Cam. 350 ×.)

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Plate VII.

Pleurophyllidia euchroa, B.

FIG.
1. First lateral plate.
2. A plate from the middle of a series.
3. Outer end of series of plates. *a*, outermost.
   (Figs. 1–3 by Cam. 350 ×.)
4. Everted vestibulum with vulva and glans penis.
5. Glans penis. 55 ×.

Janolus capensis, B.

6. An epinotidium.
7. Upper end of rhinophore.
8. Anal papilla with a rectum.
9. Left mandible from the inside. 4/1.
10. The same from the outside.
11. The bulbus pharyngeus, from the under side.
12. Left mandible of another individual, from the inside. 4/1.
13. The same from the outside.
14. Crest anteriorly on the upper side of the lamina between the fore-end of the mandibles.
15. Cartilaginous plates between the hinder end of the mandibles, from the side.
16. The same, from beneath.
17. A median plate of the rasp, from beneath.
18. A lateral plate.
19. One of the largest lateral plates.
    (Figs. 17–19 with Cam. 350 ×.)
20. The posterior intestinal mass (liver, &c.), from beneath. *a*, œsophagus.
21. The penis.

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14

Plate VIII.

Doriopsis callosa, B.

FIG.

1. End of the everted glans.
2. Armature in the vas deferens.
3. Spicula of the skin.

(Figs. 1–3 by Cam. 350 ×.)

4. Hinder end of the bulbus pharyngeus. *bb*, salivary glands, between them the buccal ganglia; *c*, œsophagus.

Doriopsis, sp.

5. Penis with everted vas deferens. 15/1.
6. Armature of the glans.

Doriopsilla capensis, B.

7. End of glans.

(Figs. 6–7 drawn by Cam. 350 ×.)

Tritonidoxa capensis, B.

8. Fore-end of the animal, from beneath.
9. Mandible, from the inside. 6/1.
10. Masticatory edge, from the inside.
11. Median and first lateral plate.
12. Lateral plates, from the inside and from the outside.

(Figs. 10–12 drawn by Cam. 350 ×.)

13. End of the penis. 100 ×.

Pleurophyllidia Gilchristi, B.

14. Piece of masticatory edge.
15. Median plates.
16. First and second lateral plates.
17. Outer end of two series of plates.
18. Plate of the inner third of the radula.

Pleuroph. microdonta, B.

19. Median plates.
20. Denticles of the same.
21. First lateral plate of two series.
22. Hook of lateral plate from the middle of a series.

(Figs. 14–22 by Cam. 350 ×.)

Pleuroph. capensis, B.

23. Median plate. 200 ×.
24. Lateral plate. 350 ×.

Pleuroph. euchroa, B.

25. Median plate. 350 ×.

F. Bergh

Werner & Winter Frankfort°M. lith.

Plate IX.

Melibe rosea, Rang.

FIG.

1. From the upper side of the cowl with the outer series of cirrhi. *a*, nodules.
2. Epinotidium.
3. Bulbus pharyngeus with—*a*, mouth-tube; *b*, region of the mandibles; *c*, œsophagus.
4. From the inside of mouth-tube. 350 ×.
5. The mandibles, from the fore-side, the left overlapping the right. 35 ×.
6. *a*, Œsophagus; *b*, stomach with the plates shining through; *c*, left biliary duct; *d*, pocket-like widenings near the pyloric part of *e*, the intestine.
7. *a*, Œsophagus; *b*, stomach; *cc*, biliary ducts.
8. Surface of one of the nodules of an epinotidium.
9. Ramificated renal tube.
10. End of a renal tube.
11. Cells of a renal tube.
    (Figs. 10–11 by Cam. 350 ×.)
12. Last half of the glans penis. 55 ×.

Marsenia capensis, B.

13. From the anterior margin of the mandible. 55 ×.
14. Median plate.
15. Median plate from a larger individual.
    (Figs. 14–15 by Cam. 200 ×.)
16. The penis.

Marsenia leptoconcha, B.

17. Mandible. 9/1.
18. Median plate. 200 ×.
19. End of the rasp-sheath.
20. The penis.

F. Bergh.

Werner & Winter, Frankfurt a/M. lith.

Plate X.

Marsenia leptoconcha, B.

FIG.
1. The shell, from beneath. 1/1.
2. End of the hook of a lateral plate. 200 ×.

Aplysia Gilchristi, B.

3. The animal, when living, natural size and colours.

Sigaretus planulatus, Recluz.

4. The head with tentacles.
5. A gill leaf.
6. From the structure of the gill leaf. 100 ×.
7. The penis.
8. A piece of the mandible. 350 ×.
9. A piece of the rasp. *a*, median plate; *b*, lateral plate; *c*, outer plates. 200 ×.
10. Median plates, from the upper side.
11. The same, from the under side.
12. The same, obliquely from above.
13. The lateral plates.
14. Outer plates, from the backside. *a*, interior; *b*, exterior.
15. Outer plates, from the side.
    (Figs. 10–15 by Cam. 350 ×.)
16. The rasp-sheath.

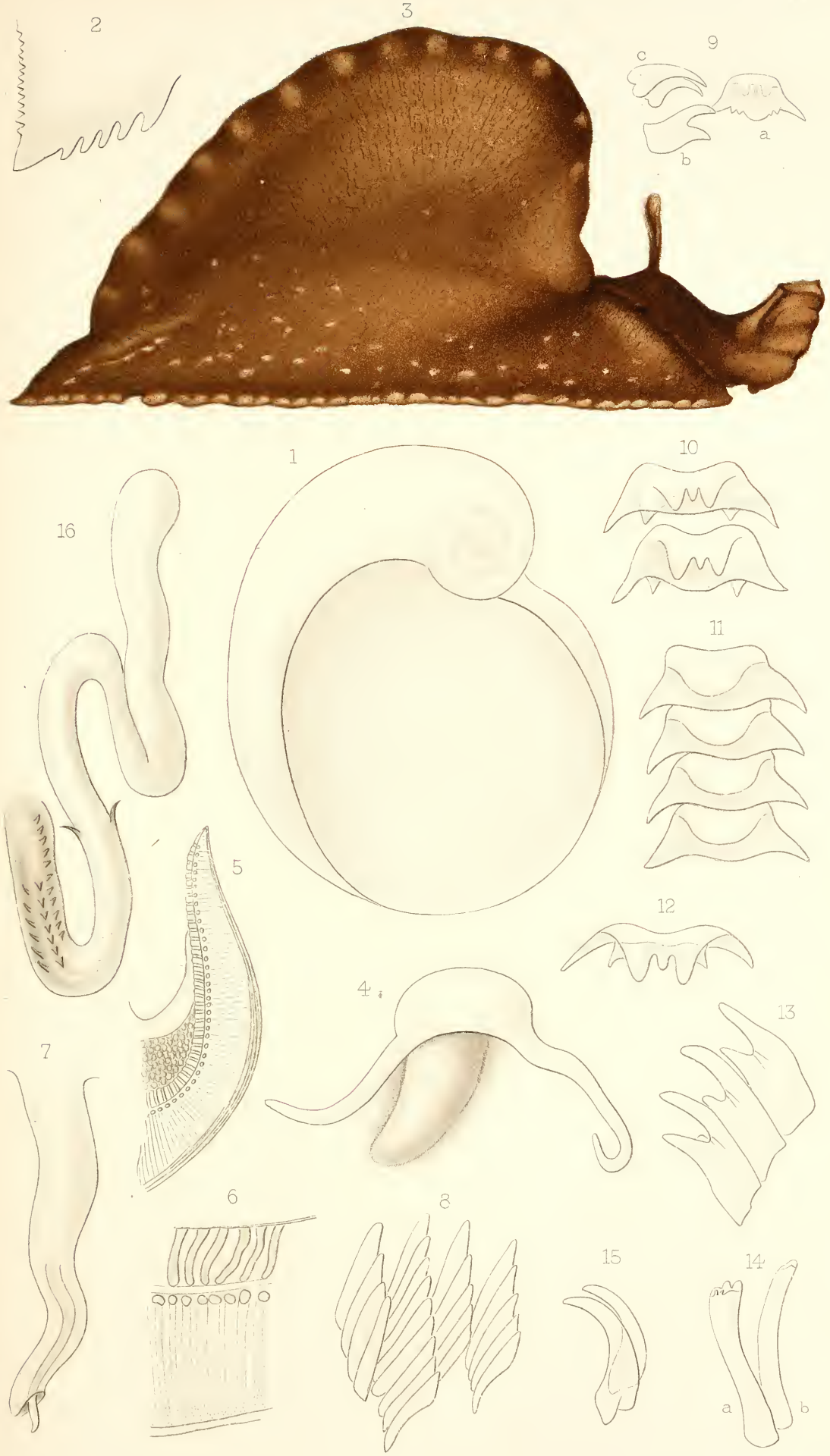
2
3
9
c
a
b
1
10
16
11
5
12
4
13
7
6
8
15
14
a
b

Plate XI.

Pleurobranchæa capensis, Vayss.

FIG.

1. Piece of the mandibular plates, from the side.
2. A piece of the mandibular plate, from the upper end.
3. One of the largest plates of the rasp, from the margin.
4. A similar one from the fore-side.
5. A plate from the middle of a series.
6. Outermost end of a series.

(Figs. 1–6 drawn by Cam. luc. 350 ×.)

7. The præbranchial sac.
8. End of the internal sheath of the vas deferens.

Oscaniella nigropunctata, B.

9. Squares of the back, partly with black centre.
10. The shell from the upper side. 9/1.
11. Serpent-like filaments of the skin of the back.
12. Element of the mandibular plate, from the upper side.
13. Similar, from the side.
14. Similar, from the under side.
15. Inmost plate of the rasp.
16. Plates of the inner part of the rasp.
17. Largest plate from the middle of the rasp.
18. Outer end of a series of plates. *a*, outermost of 7 plates.

(Figs. 11–18 drawn by Cam. 350 ×.)

Archidoris scripta, B.

19. The animal, from the back side. 2/1.
20. Spikel of the skin of the back.
21. Plates of the outer part of the rasp. *a*, outermost.
22. Plate from the median part of a series.
23. Largest plate.
24. Outer end of a series of plates. *a*, outermost plate.

(Figs. 20–24 drawn by Cam. 350 ×.)

25. *a*, Spermduct; *b*, penis; *c*, præputium with glans.

Staurodoris verrucosa (Cuv.).

26. Plates of the middle of the rasp.
27. Outer end of a series of plates. *a*, outermost plate.

Aphelodoris brunnea, B.

28. Innermost plate of a series of the rasp.
29. Outer end of a series of plates. *a*, outermost.

(Figs. 26–29 drawn by Cam. 350 ×.)

R. Bergh.

Werner & Winter Frankfurt a. M. Lith.

Plate XII.

Aphelodoris brunnea, B.

FIG.

1. Anterior genital mass. *a*, hermaphrodite duct; *b*, muco-albuminous mass; *cc*, prostata, vas deferens; *d*, vestibulum genitale; *e*, spermatotheca and spermatocysta.

Geitodoris capensis, B.

2. Piece of the lip-plate.
3. From the inner part of the rasp. *a*, innermost plate. 200 ×.
4. Plate herefrom.
5. Outer end of series of plates. *a*, outermost plate.
   (Figs. 4–5 drawn by Cam. 350 ×.)

Triopa lucida, Stimpson.

6. Club-shaped appendix of the back.
7. *a*, First; *b*, second lateral plate; *c*, outer plate.

Nembrotha capensis, B.

8. Bulbus pharyngeus, from the upper side. 4/1.
9. Median plates.
10, 11, and 12. Lateral plates in different positions.
13. The outer plates. *a*, outermost.
14. Innermost (first) of the outer plates.
    (Figs. 9–14 drawn by Cam. 100 ×.)
15. Hooks of the penis.
16. *a*, Spermatotheca; *b*, spermatocysta.
17. Vestibular gland.

Euplocamus croceus, Phil., var. capensis.

18. Head with tentacles and fore end of the foot.
19. Arbuscule of the back.
20. Genital papilla with vulva and end of the penis with prominent armature.
21. Mandibular plate. 12/1.
22. Inner part of the rasp with the three lateral plates; and *a*, the innermost plates of the outer series.
23. End of the glans.
    (Figs. 22–23 drawn by Cam. 200 ×.)
24. Hooks of the glans. 350 ×.

R. Bergh

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Plate XIII.

Kalinga ornata, A. et H.

FIG.
1. Papilla of the back.
2. Tongue with rasp.
3. Plates from above.
4. A plate from the side.
5. Hooks of the glans penis.
   (Figs. 3–5 drawn by Cam. 350 ×.)

Idaliella amœnula, B.

6. The animal, from above.
7. The crop of the bulbus pharyngeus, from above. *aa*, glandulæ salivales.
8. Elements of the mandibular plates.
9. From the rhachis of the rasp (lateral plates).
10. *a*, Lateral plates; *b*, outer plates.
    (Figs. 9–10 drawn by Cam. 350 ×.)
11. Glans penis with projecting armature. 200 ×.

Tritonia pallida, Stimpson.

12. Left mandible, from the back side. *a*, masticatory process. 3/1.
13. Piece of the masticatory edge.
14. One of the largest plates.
15. One of the outer plates.

Tritonia indecora, B.

16. One of the inner plates.
    (Figs. 13–16 drawn by Cam. 200 ×.)

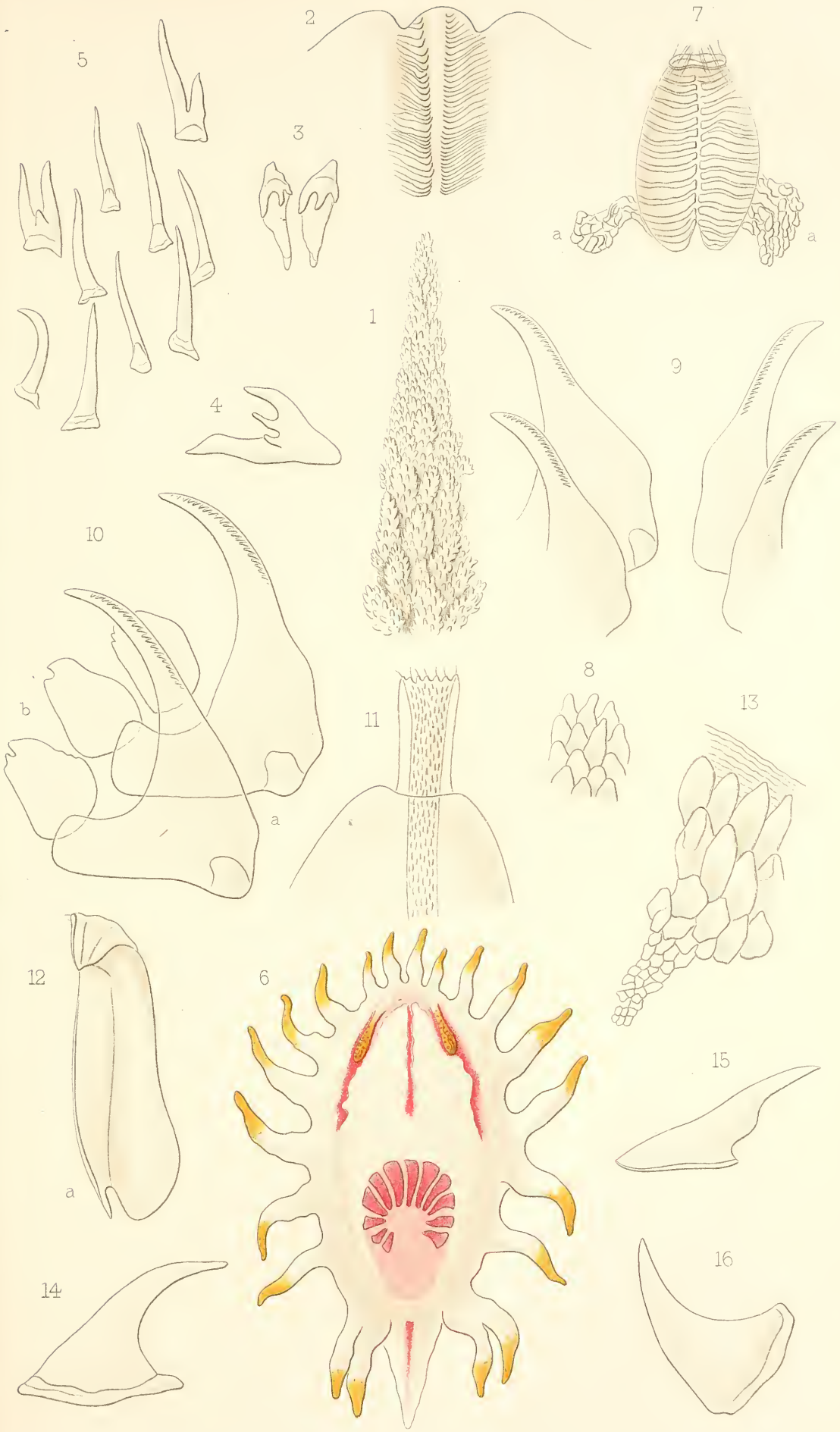
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Plate XIV.

Tritonia pallida, Stimpson.

FIG.
1. Median and five innermost plates.

Tritonia indecora, B.

2. Median and first lateral plate.
3. Two plates of the outer part of a series.

Doriopsis capensis, B.

4. Hooks of the armature of the penis.
(Figs. 1–4 drawn by Cam. luc.)

Marsenia perspicua (L.).

5. Mandibular plate. 55 ×.
6. Hinge part of the same. 200 ×.
7. Piece of the rasp.
8. Point of a lateral plate.
(Figs. 7–8 drawn by Cam. 350 ×.)
9. Penis.

Dolabella Rumphii, (Cuv.) Rang.

10. Part of the margin of the hinder disc.
11. A papilla of the back.
12. The shell, from the upper side. 1/1.
13. The nucleus, from the under side.
14. Median plate. 200 ×.
15. Median plate. 350 ×.
16. Lateral plates, from the middle of a series.
17. The two outermost plates.
18. Thorns from the palate.
(Figs. 16–18 drawn by Cam. 200 ×.)
19. Elements of the mandibular plates. 350 ×.
20. Prickles of the cardia of the second stomach.

R. Bergh.

Werner & Winter, Frankfurt a/M., Lith.

A NEW SPECIES OF PLANOCERA (*P. GILCHRISTI*) FROM SOUTH AFRICA.

(Pl. XV., figs. 1–7).

By Lydia Jacubowa, Archangel.

Among the material at my disposal occurred the above Polyclad which had been found by Dr. Gilchrist near the Marine Laboratory at Cape Town. A single specimen only was available. Although considerably contracted, it was on the whole very well preserved both with regard to external features and histological structure.

The length of the animal is 40 mm., the breadth 28 mm., and the thickness varies from 1 mm. at the sides to $1\frac{1}{2}$–2 mm. in the central region. The form of the body is broadly oval, both ends being similarly rounded; the margin of the body is strongly folded. It is of a fairly firm consistency and very little transparent.

The ground colour of the back of the specimen (preserved in alcohol) is yellowish white. On this are to be seen black spots of irregular shape, and these are grouped together in small heaps equally distributed over the surface of the back. They form a continuous black line only in the dorsal middle line, in the region of the reproductive organs. On the other hand, the region of the brain area is almost devoid of spots and forms a clear unpigmented area. The small spots are also found on the tentacles in very diminished numbers. They are formed of the pigment which lies in the dorsal epithelium of the body in the form of black particles.

On the dorsal side of the animal two high pointed neck-tentacles can be distinguished, situated 9 mm. from the anterior end, that is, at the end of the first fourth of the body. The distance between them is 2 mm. It is seen by microscopical examination that each tentacle has, at its base, from about fifteen to twenty large, well-developed eyes (fig. 2). The eyes of the brain area, which are not much smaller, are arranged in two rather elongate groups, which lie on the lateral margin of the brain, over which they extend in front and

behind. Each group consists of about twenty to twenty-five eye spots. The brain is well developed and surrounded by a strong capsule somewhat flattened dorso-ventrally. It is far removed from the anterior end and is situated near the pharyngeal sac. The anterior nerve cords and the nerves of the tentacles are remarkably well developed.

On the under side, which is of a dirty white colour, may be seen, even with the naked eye, the mouth and the genital openings, the female opening being surrounded by a fairly well-developed raised wall.

The pharyngeal apparatus is broad and short; it is less than a third of the length of the body and ends close to the male genital apparatus. The pharyngeal sac, which is provided with deep lateral sacs, conceals a strongly folded pharynx, the folds of which are not of any great thickness. The outer mouth lies somewhat in front of the middle of the body and at the commencement of the posterior half of the pharyngeal sac. The gut-mouth is placed somewhat in front of the outer. It leads into a spacious main gut which does not project beyond the pharyngeal sac either in front or behind. It gives off on each side six intestinal branches. The anterior middle branch is rather narrow at that part which lies over the brain, and beyond this it gradually becomes wider. The tree-like branched intestinal canals are exceptionally wide, and are, like the main intestine and pharyngeal cavity, quite filled with food material, the origin of which cannot be determined.

The reproductive organs occupy a relatively large space. They are altogether about $7\frac{1}{2}$–8 mm. in length, or one-fifth of the total length of the body. The female sexual aperture is situated 8 mm. from the hinder end of the body, that is, between its fourth and its last fifth. The male sexual aperture is situated 5 mm. in front of the female, that is, at the commencement of the last third of the body. The penis and the granule-gland (figs. 3 and 7) of the male and the bursa copulatrix (fig. 7) of the female sexual apparatus appear very peculiarly formed. The penis is a large barrel-shaped muscular organ directed backwards. It passes obliquely from in front and ventrally, to the posterior and upwards. On its dorsal wall is a fairly deep fold. The ductus ejaculatorius, which penetrates the organ, occupies a corresponding position — passing obliquely from in front and ventrally to the posterior and upwards, so that its free end is directed against the dorsal body wall. This position appears to me to be an artificial product, probably brought about by the strongly contracted condition and the consequent folding mentioned above, for the expansion of these parts would

bring about a more normal and horizontal position in the body. The penis consists of a delicate outer muscular tissue and an inner alongside of the ductus ejaculatorius. The musculature is specially well developed at the base of the penis where the inner joins the outer. The arrangement of the muscle fibres is so complicated that I was unable to determine it with certainty. Radially arranged muscular fibres pass from the inner to the outer musculature, the remaining space between which is filled with connective tissue and parenchyma cells. The free surface of the penis bears chitinous spines and is surrounded by the very spacious antrum masculinum produced by a folding in of the ventral wall of the body. The spines (fig. 5) are small, closely set, and with their points slightly bent forwards. In the neighbourhood of the free end of the ductus ejaculatorius the spines are modified in such a way that they appear in the form of small irregular processes which are twice as long as the spine (fig. 4).

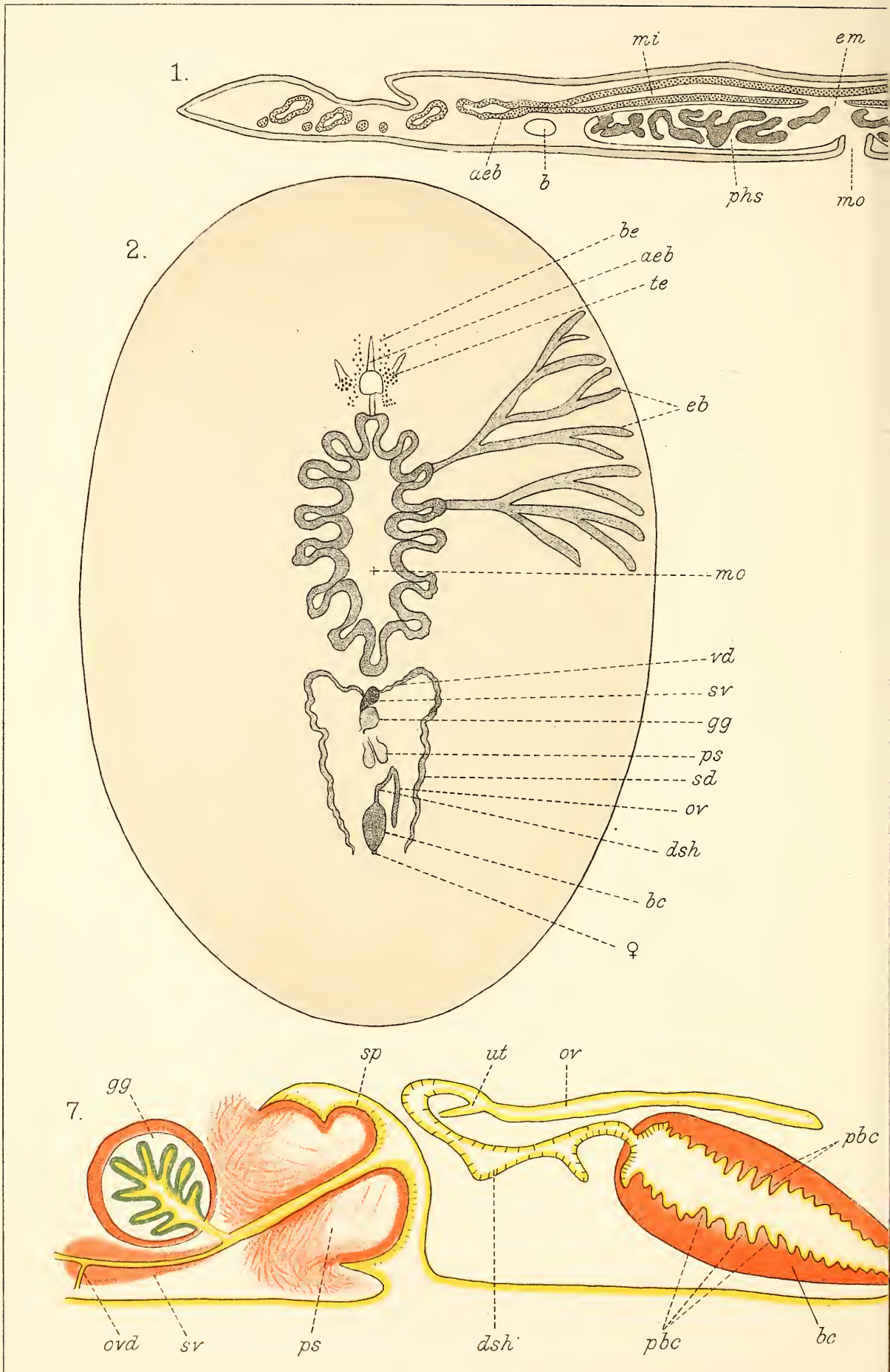
The ductus ejaculatorius, which is lined with a cubical ciliated epithelium, extends to the fixed end of the copulatory organ and here divides into a dorsal branch leading to the granule-gland and a ventral branch leading to the seminal vesicle. The granule-gland is rather peculiarly shaped, as shown in fig. 3. It has a central canal with smaller branching canals, which run approximately in the radii of the granule-gland and open at various places in the central canal; this last leads into the ductus ejaculatorius, into which its distal end opens. The radial canals are surrounded by numerous small glandular cells, the small elongate nuclei of which are situated at their bases. The number of glandular canals is considerable; ten to eleven are to be seen in median longitudinal section, and they may altogether be present in considerably larger numbers. The thin musculature of the granule-gland consists of longitudinal muscle fibres provided with nuclei. The numerous nuclei of the parenchyma lie on the outside of these. Extracapsular glands are not present. Below and somewhat in front of the granule-gland lies a small oval seminal vesicle provided with a low flat epithelium. Its musculature is constituted of felt-like somewhat loose fibres. Both the vasa differentia open separately into its blind end. Behind the pharynx they turn round and pass into the large seminal ducts. They are short, somewhat coiled canals with a collection of parenchyma nuclei round their epithelium. Anteriorly they extend to the posterior end of the pharynx and posteriorly to the neighbourhood of the female genital opening without however joining here.

We have to do with an animal not quite sexually mature, and whose sexual apparatus is not yet quite functionally perfect. The

testes are not well developed, the seminal ducts not broad and containing no spermatozoa. The immaturity of the female sexual apparatus is recognised by the limited number and size of the ovaries, as also by the poorly developed uteri and shell gland.

The bursa copulatrix of the female copulatory apparatus is in the form of a large strong muscular egg-shaped organ, the pointed end of which is directed backwards. The inner surface of the bursa copulatrix is provided with rather large closely set papillæ. The largest lie in the centre of the organ, and they gradually diminish in size towards the anterior and posterior regions. They are provided with a broad basis and are partly drawn out into points and partly more or less rounded off. The papillæ are covered with an epithelium which is a continuation of the ventral epithelium of the body, and this varies in different parts of the bursa copulatrix; at its distal end it is extremely flat and its cells are only to be distinguished by their nuclei. Nearer, on the larger papillæ, it loses its nuclei, becomes thickened and assumes the appearance of a strongly refractive chitinoid membrane, coloured an intense yellow with picric acid. In its further course it again assumes the characteristics of a flat epithelium, which becomes glandular in character at its anterior end. The papillæ in the bursa copulatrix probably serve in some sort of way as accessory organs of copulation. The anterior end of the bursa copulatrix, which is provided with glandular epithelium, may be regarded as the beginning of the duct of the shell gland, which runs further forward. The shell glands occur in fewer numbers in the epithelium of the duct; in its neighbourhood, *i.e.*, in the parenchyma, there are however none present. The duct is continued forward to the region of the male genital apparatus, here bending round in a backward direction and passing into the oviduct. This is clothed with a cubical epithelium; at its commencement it includes a common part of both uteri and is continued to a point over the middle of the bursa copulatrix. The accessory vesicle is absent. The uteri consist of narrow canals which do not contain any eggs. I was unable to follow them throughout their whole course.

This animal belongs to the family of the Planoceridæ, in which it agrees most closely with the genus Planocera, group A, but it differs considerably from other species of Planocera. The male copulatory apparatus is characterised by the abnormal structure of the penis and the granule-gland. The difference of the female apparatus from that in other species of this group consists in the peculiar structure of the bursa copulatrix, which is provided with papillæ, and in the absence of the accessory vesicle. I have named this animal *Planocera Gilchristi* in honour of its discoverer.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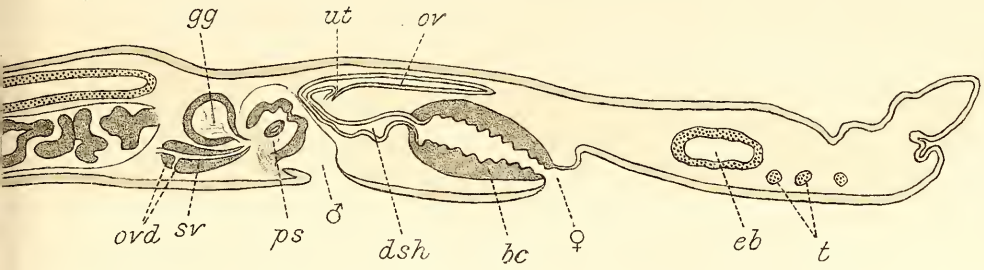

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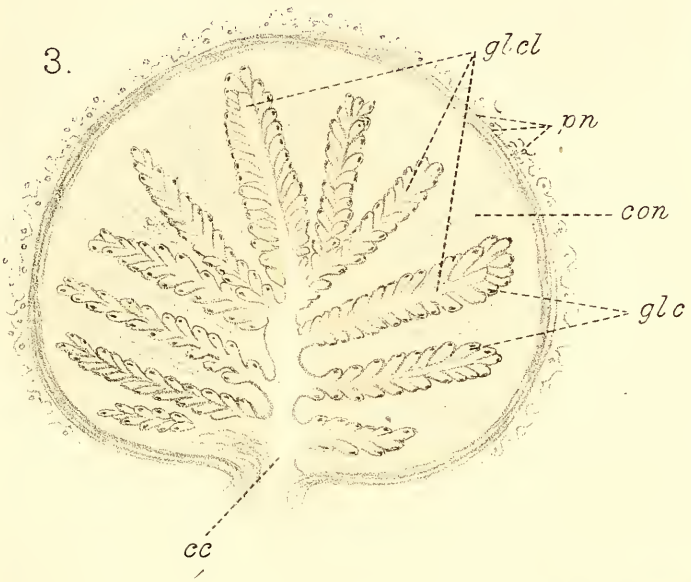

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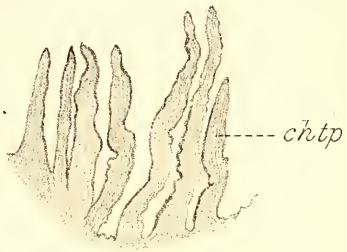

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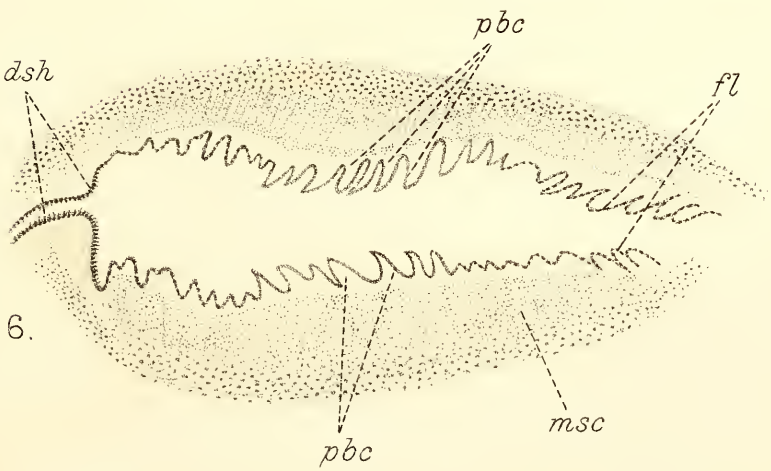

West, Newman chromo.

EXPLANATION OF FIGURES.

(For all figures.)

a e b = anterior enteric branch.
b = brain.
b c = bursa copulatrix.
b e = brain eyes.
c c = central canal of the granule-gland.
cht p = chitinous processes of the male copulatory organ.
con = connective tissue.
d sh = duct of shell gland.
e b = enteric branch.
e m = enteric mouth.
fl = flattened epithelium.
g g = granule-gland.
gl cl = canals of the granule-gland.
gl c = glandular cells of the granule-gland.
m i = main intestine.
m o = outer mouth.
msc = musculature.
ov = oviduct.
ov d = opening of the vasa deferentia into the seminal vesicle.
p b c = papillæ of bursa copulatrix.
ph s = pharyngeal sac.
p n = parenchyma nuclei.
ps = penis.
s d = seminal duct.
s p = spines of penis.
s v = seminal vesicle.
t = testes.
t e = tentacular eyes.
ut = opening of uterus to oviduct.
v d = vasa deferentia.
♂ = male genital opening.
♀ = female genital opening.

Plate XV.

FIG.
1. Longitudinal section. Enlarged ca. 5.
2. Sketch of anatomy.
3. Granule-gland, median longitudinal section. Obj. 3, Oc. 3.
4. Chitinous processes round the ductus ejaculatorius. Obj. 5, Oc. 0.
5. Spine of penis from a longitudinal section through the copulatory organ. Obj. 7, Oc. 3.
6. Longitudinal section through the bursa copulatrix. Obj. 2, Oc. 0.
7. Schematic representation of the copulatory apparatus.

NEW FORMS OF THE HEMICHORDATA FROM SOUTH AFRICA.

I. Phoronopsis albomaculata, g. et sp. n.
II. Phoronis capensis, sp. n.
III. Ptychodera capensis, sp. n.

By J. D. F. Gilchrist, M.A., D.Sc., Ph.D., C.M.Z.S.,
Government Biologist to the Colony of the Cape of Good Hope.

(With Plates XVI., XVII.)

(Read June 26, 1907.)

Introduction.

The three orders of the Hemichordata* prove to be represented in South Africa: the Enteropneusta by the form here described; the Pterobranchia by a new species of Cephalodiscus †; and the Phoronidea by the two forms mentioned above.

A species of Phoronis is not uncommon in South African seas, and individual specimens are readily obtained in limestone and amongst incrustations of Polyzoa and worm tubes dredged from shallow water (15 to 30 fathoms).

A number of the animals were, however, obtained in a much simpler way. About the beginning of May, 1906, numerous specimens were observed in a tank at the Government Marine Laboratory, and there is evidence that they had been brought in with the supply water as larval forms. They were first seen in a small piece of limestone which had been procured from a depth of about 20 fathoms in False Bay some time previously, and it was thought that they had been brought in with the stone. Further search, however, in the tank resulted in the discovery of other

* Adopting for the present purpose Harmer's subdivisions of this group (*vide* "Cambridge Natural History," vol. vii.).

† *Vide* "Marine Investigations in South Africa," vol. iv., pp. 173–192.

individuals, one in a large limestone rock which had been for some months out of water before being used to form part of the rock-work in the tank, three in a small piece of stone at the further end of the same tank introduced later, and a solitary specimen in another tank. Further evidence was afforded by the fact that a dried piece of limestone put into the tank for the purpose of confirmation had at least one Phoronis on it about eight months afterwards.

During the examination of the specimens in the limestone a single specimen (A) was observed which appeared to be a different species, being larger, of a somewhat different form, and pigmented. This was the only one of its kind then found, and special care was taken to observe its habits and behaviour in the living condition before preserving it for more detailed examination. It appeared to be thriving and specially active, and it was disappointing to find, on proceeding to examine it again, that this unique specimen had entirely disappeared, leaving only the end of the tube visible. After a time, however, the headless trunk of the animal was slowly protruded, and a month later the head region had apparently grown to its former dimensions. Fig. 2 is from a photograph of the animal at this time.

Only two other specimens (B and C) of this species have as yet been procured, but it will probably be found that the animal is not so rare as would seem to be indicated.

With regard to the first species (*Phoronis capensis*, sp. n.), there is little of special interest; but as the specimens, on account of their hardiness and their thriving so well in captivity in spite of somewhat severe handling, afforded excellent material for observation of their habits and certain features of the living animal, an opportunity was taken to add a few details to the little that is known on these points. Fig. 1 represents one of this species carrying eggs, and is from the living animal.

The second species is of more interest structurally. It shows an apparent advance on species hitherto described in the circum-œsophageal nerve ring being partially sunk in an involution of the epithelium of the body, the single nerve chord being well developed, the nephridia somewhat modified, the longitudinal muscles of the body increased in number, and ova deposited in gelatinous mass in the tube instead of in the tentacles.

These distinctive features, especially the first, seemed to necessitate the separation of this form from others as a new genus—*Phoronopsis*.

The following description of this animal is necessarily somewhat incomplete on account of the limited material available, but I hope

to procure additional specimens to check and supplement it. Transverse sections were made of specimen A and longitudinal sections of B.

I.—PHORONOPSIS ALBOMACULATA.

(Plate XVI., fig. 2.)

PHORONOPSIS, g. n.

The body is asymmetrical, muscles of body being numerous and more developed on left side, one nerve chord well developed, and nerve ring in an involution of the epidermis, ova deposited in gelatinous mass in the tube.

In all the species of Phoronis hitherto described the body is symmetrical or asymmetrical, as indicated by the development of the muscles and nerve of the left side; the muscles of the body are markedly less in number than in Phoronopsis, and there is no trace of any involution of the epidermis at the nerve ring; the ova and larvæ are lodged in the coils of the lophophore.*

There seems little doubt of the necessity of separating this form from those hitherto described.

Phoronopsis albomaculata, sp. n.

Size.—The length of the animal removed from its tube was 18 mm., the diameter of the body 1 mm. immediately below the lophophore and 2 mm. at a distance of 4 mm. from the opposite extremity. The diameter of the lophophore from tip to tip of tentacles, when the animal was alive and completely expanded, was 7·5 mm.

Tube.—The tube is larger than that of *P. capensis*, being 1·2 mm. in diameter. It is not embedded—*i.e.*, it does not penetrate the substratum, but rather lies on it, being firmly attached by one side. The substance of the tube spreads over the substratum on the attached side, so that in sections it does not appear circular, but is flattened on one side.

The tube is about 30 mm. long, and, in the specimens, was irregularly curved, so that the two ends lay near each other. Its substance was apparently of the same nature as that of *P. capensis*, but firmer and of a much tougher consistency. It was covered by grains of sand and pieces of shell arranged in no definite manner.

* Longchamps (8) observed the eggs of *Phoronis Müller*i being discharged directly into the water, and suggests that this may be normal.

Colour.—A pure white pigment of finely branching chromatophores occurs in spots irregularly placed on the tentacles. These spots were somewhat elongate in the direction of the length of the tentacles. To the naked eye each appears as a solid spot, but when examined with a lens is seen to be more or less divided longitudinally, and to consist in reality of two patches, one on each side of the tentacle. At the base of the tentacle they are more numerous, and form a continuous line along the lophophore near the oral region so as to form an incomplete circle. At the median point (that is, the mouth region) a strip of pigment passes backwards towards the anus (or along the dorsal aspect of the animal), and ends in a slightly enlarged circular patch. Whether or not this spot coincides with the anus, as it appears to do, could not with certainty be made out as the pigment was not visible in sections. The white pigment extends on to the body in few and irregular streaks below the lophophore.

Apart from this pigment the tentacle and lophophore were clear, transparent, and apparently colourless. The body, however, was of a faint yellowish colour.

Nervous System.—The single nerve along the left side of the body is well developed. The nerve cells are numerous and well developed, and are arranged so as to form a solid rod (*cf.* Caldwell (**3**), Cori (**4**), Longchamps (**8**). A transverse section showed that this nerve is not hollow, the centre being occupied by a clear, refractile, non-staining substance. The nerve was thus, as a whole, partly differentiated from the epithelium, but not sinking away from it.

In following the sections upwards however it is seen that as they approach the duct of the nephridia the nerve gradually leaves the epithelium of the body, and when the duct (double, as it is here in the form of a loop) is cut the nerve is seen internal to it. Succeeding sections show that, after the nerve has thus passed over the duct on the inside, it again passes out between the two limbs of the duct before joining the circum-œsophageal ring of nerve tissue; in other words, on coming to the nephridial duct it passes over it on the inside in place of continuing on the outside, where the epidermis of the body is. This twisting of the lateral nerve may be associated with the marked distortion of the body. The anus, at one time terminal, has come to lie near and behind the mouth. The nephridial opening, at one time probably ventral and below the lateral nerve chord, has been carried upwards, necessarily passing over the lateral nerve chord, and finally attains a position near the anus.

The passing of the opening of the nephridial duct over the nerve

may also be associated with its separation from the epidermis at this point.

The most striking feature of the nervous system, however, is to be found in the character and position of the nerve ring. It is sunk in a comparatively deep involution of the epidermis, which is so intimately connected with the nervous system that it is most conveniently dealt with here. This involution or fold of the epidermis passes from the oral side of the animal round on each side, following the course of the nerve ring, till, on reaching the lophophoral opening, in or near which are situated the anal and nephridial apertures, it is continued round the body, passing outside these organs.

The fold can readily be seen with a low magnifying glass. It varies greatly in depth ; outside the anus it is a mere ridge ; it is deepest at the sides of the body, being about one-fourth of its diameter. Anteriorly, *i.e.*, in the oral region, it becomes somewhat shallower.

The general character of the histological elements of this fold is indicated in fig. 4. The external part is identical in structure with the general epithelium of the body—a layer of deep epithelium cells, including glandular cells. Towards the tip of the fold, however, these cells become smaller and lower, and at the tip somewhat abruptly change in character and become low, square, with comparatively large, round nuclei, and without distinct cell demarcations. These are continued down to the bottom of the fold, where they once more abruptly change into deep elongate cells, with punctated nerve substance. The nervous epithelium of the nerve ring does not, therefore, participate in the folding.

In some sections of the fold a few cells occur between the cubical epithelium and the epidermis, and apparently a space which is not coelomic. The existence of a space is doubtful, however, and may be an artifact.

In life, the small cubical epithelium of the fold is applied to the nervous epithelium, the lip of the folding not standing out as shown in the figure, which is from a specimen (B) killed and fixed in sublimate. In the other specimen (A), which was treated in practically the same way (fixed in sublimate with 1 per cent. acetic acid) before removal from the tube, the lip of the fold was closely applied to the body.

The epithelium of the nerve ring is not entirely covered by the fold, even when closely applied to it. In the region of the organs, which for want of a better name I have called "olfactory organs," it extends beyond the fold and is freely exposed. The nerve ring is

therefore elongated, or broadened upwards towards the tentacles here, and, in the same region, elongated downwards in the lateral folds. This downward elongation comes in close approximation to the nephridia, as shown in fig. 5, which is a transverse section of specimen A.

With regard to the interpretation of this organ, the most obvious suggestion is that it is of the nature of an introvert, such as occurs in the Polyzoa and Sipunculoidea, and, if so, it might form another link between the Phoronidea and these groups. It seems probable from its size, structure, apparent absence of retractor muscles, and intimate relation with nerve ring, that it does not however act, to any great extent at least, as an organ for the withdrawal of the body, or any part of it—a function which is most efficiently performed by the numerous and powerful muscles of the body.

In specimen A we are dealing with a regenerated head, not impossibly in B also, and it might be suggested that the fold is a stage in the complete separation of the nerve ring from the epidermis—a condition which might occur in a completely developed specimen, though the nature of the folding does not seem to support such a view.

If any phylogenetic significance is to be attached to the form of this organ, which is possible, it may be that it is the remnant of an ancestral introvert which has been retained with the new function of protection of the nerve ring.

Muscles.—The longitudinal muscles of the body were numerous and well developed, especially on the left side. In the region just below the nephridia there were 32 in the left oral chamber, 30 in the right, 18 in the left anal chamber, and 14 in the right, or, according to Longchamps' formula, $\frac{32}{18}\frac{30}{14}$.

Lophophoral Organ.—In specimen A this organ was not present, but in specimen B it was very marked, being a deeply staining mass of glandular cells.

Tentacles.—The tentacles were numerous—126 in specimen A. They were a little over 3 mm. in length, and ·08 mm. in diameter.

Septa.—The septa seemed to be of the usual number and disposition. The transverse septum was in part without basement tissue. In median longitudinal sections there appeared an offshoot towards the epistome—a condition which requires further examination and confirmation on other specimens.

Nephridia.—The two nephridial tubes are well developed, and in preserved material were bent on themselves, forming a loop, the limbs of which appeared of about equal length. As described above, the nephridial tube of the left side passes between the nerve and the

external epithelial layer of the body. Internally the nephridia opened in the lateral mesenteries, there being two very marked and wide openings to each. These openings were composed of deeply staining masses of cells, which extended up on to the transverse septum. They were not, as in other species, continued down on the lateral mesenteries.

Ova.—Specimen C was in all respects like in general form and colour to A and B, so far as could be ascertained by microscopic examination of the living animal protruding from its tube. There were no eggs or embryos in the tentacles, but, on one occasion, when the animal was retracted, a large number of ova were seen lining the mouth of the tube, and these were held together by a gelatinous substance. The eggs were slightly yellow in colour and ·1 mm. in diameter. They were all in a very early stage of development. Both the animal and eggs were torn off, probably by a fish or other animal in the tank, only a part of the animal and tube being left, so that later stages of the eggs were not observed.

II.—PHORONIS CAPENSIS, sp. n.

(Plate XVI., fig. 1.)

There are no satisfactory features by which the various forms, which are here included under the genus Phoronis, to which this species belongs, may be separated from each other, and the description of a supposed new species cannot be drawn up on very definite lines, but rather with a view to affording details, some of which may subsequently be found to be of systematic value. Such particulars are size, form, colour, number of tentacles, tube, number and development of longitudinal muscles, nerve chord, &c.

Size, &c.—The body of this species is neither particularly large nor small. The largest specimen was not more than 1 mm. in diameter at the end of the body immediately below the lophophore. This might be reduced to about half this diameter when the animal was fully extended from its tube. The total length of a specimen removed from its tube was 21 mm., the smallest diameter of its body 1 mm., and the greatest 1·3 mm. (near the basal end).

The living animal is clear, colourless, almost transparent. The tube in which it lives is circular and of a brown, horny-like substance, not easily ruptured, and is not confined to any special substratum, but may occur embedded in limestone or between any

calcareous tubes of other animals, even among calcareous algæ. (See below for further details.)

Nervous System.—This is essentially as described in some other species. There are two very fine tracts of punctated nervous tissue running along each side of the body where it is joined by the lateral septa.

Beneath these, on or in the basement membrane, could be detected a very fine tube, such as has been described. No nervous tissue was found anywhere separated from the epidermis. The specially developed patches of nerve tissue at the base of the lophophore were present as described by Benham (**2**) for *P. australis*, and, for reasons stated further on, are perhaps to be considered as olfactory organs.

Another patch of nervous tissue, apparently representing a sensory organ, was found at the base of the epithelium of the floor of the mouth where it joins the transverse septum. The tissue is less developed and definite than in the previous case, but, taken in conjunction with the observations below, it would seem to be an organ of taste, or at least of discrimination of food particles, of which there is a very definite selection and rejection (fig. 6 *ne'*).

Musculature.—The longitudinal muscles of the body are fairly well developed. Near the nephridial region they are symmetrical, that is, an equal number on the right and left of the median septum. According to the convenient formula of Longchamps they would be $\frac{12}{4}|\frac{12}{4}$, that is, 12 in the right and left anterior chamber, and 4 in the right and left posterior. This, however, was not constant, and $\frac{12}{4}|\frac{11}{4}$ and other combinations were observed.

Lophophoral Organ.—This organ in *P. capensis* appears to be essentially similar to that in other described species.

In view of the observations on this organ in the living animal, two parts are to be distinguished. First, the glandular epithelium at the base of the lophophore below the tentacles forming the lower part of the brood chamber. This glandular epithelium extends up on the inner side of one or two of the tentacles, that is, into the region where the more developed embryos lie. It is readily seen in sections that the mucus from the epithelium envelops the eggs, and the mucus with which the mass of developing eggs and embryos are held together is very apparently from this source. Secondly, a free continuation of the epithelium out from the lophophore. The cells here assume rather the characteristic of ordinary epithelium (ciliated). Though in sections little more than a slight projection or fold, this part in the living animal is broad and leaf-

like, and functions as an organ for conveying the eggs from the nephridial opening to the brood chamber as described below.

Tentacles.—The number of tentacles in specimens with eggs, and therefore probably full grown, is about 90, though much fewer were observed in others with rejuvenating (?) heads and in small specimens.

The number of coils of the lophophore when contracted (in sections) was at most one and a half on each side, and, when fully extended, one, that is, in the circle of tentacles, the course from a point in front of the middle of the mouth to a corresponding point behind, was about circular with a slight re-entering curve in which the eggs were lodged (*vide* fig. 1). The coils were flat, that is, not in a turreted form as described in *P. australis* (**2**) and *P. buskii* (**7**).

Septa.—A transverse septum exists in *P. capensis*, but it is not of the same character as in *P. australis* (**2**). In the latter it is composed of a homogeneous dense matrix with embedded cells and spaces lined by cells. This condition, which I have also found in section of *P. hippocrepia*, may have been brought about by the invasion of the septum by the gelatinous basement membrane of the body wall. In *P. capensis* only a part on each side and behind is so invaded, the rest of the septum being composed of the closely applied coelomic epithelium of the supra- and infra-septal cavities, so that in longitudinal section near the right or left body wall the septum appears of the character found in *P. australis*, while in a median longitudinal section the septum is in the form of cells without basement tissue. The characteristics of the septum in this respect would probably be of value in specific determination, but it has not been described for most species.

The mesenteries of the cavity below the transverse septum are of the same character. Gaps, however, occur in them, and the two layers are not always evident. In the nephridial region of the lateral septa the basement tissue, however, appears.

Nephridia.—There are two nephridia. In addition to the large opening into the rectal chamber, there is a smaller into the lateral chamber. The rectal opening is continued down the mesentery for a considerable distance, as described in *P. australis*, and other species.

Circulatory System.—Some of the details of the course of circulation were made out by examination of sections, but chiefly by observations on the living animal. They showed that the circulation was apparently different from that of *P. australis* (**2**).

In sections, the afferent vessel was seen to be divided into two

branches, but these do not pass into "circular" vessels only, but lead by a large vessel (often swollen up into a large cavity full of blood corpuscles) directly into the two branches of the efferent vessel, so as to effect a direct communication between afferent and efferent vessels.

This was confirmed by observation on the circulation in the living animal as given below, where the circulation is more fully discussed.

Affinities of P. capensis.—The species seem nearest to *P. hippocrepia.* It differs from specimens of this species which I have examined in the structure of the transverse septa, as already indicated, and in the number of tentacles. The latter characteristic is, however, very variable, and the value of the former as a specific characteristic is not yet proved, and it is by no means certain that the forms are distinct.

The wide geographical separation of the species can reasonably be accounted for by the habits and modes of occurrence of the animals as here described. If they can be conveyed through a pump, a long pipe, with a fall of about a foot into a tank of water, and become affixed to a stone, it is more than probable that they will lodge in the material which accumulates on ships' bottoms, or floating pieces of wood, and be carried great distances in this way.

Observations on Behaviour and Habits of Phoronis capensis.

There is still some considerable doubt on many points connected with the general habits and certain physiological phenomena of Phoronis. Its formation of what might be called "pseudo-colonies," in which there is apparently no co-operation or advantage to its individual members; how the animal apparently penetrates solid limestone; how the tube is formed; how food is ingested; function of the "lophophoral organ" and of epistome; nature of sense organs, if any; whether the movement of the blood is real circulation or merely oscillation—these and other points still remain somewhat obscure.

The following notes are based on observations for a year on a "colony," and on specimens occasionally procured by dredging, and also on repeated observations made under the microscope on specimens living in as normal conditions as possible. For convenience, I have arranged these under the following heads :—

(*a*) Mode of occurrence, formation of tube, boring (?), colony formation.

(*b*) Tentacles, muscular and ciliary movements.

(*c*) Eggs, larvæ, oviposition, breeding season.
(*d*) Lophophoral organ, lophophoral gap, epistome.
(*e*) Sensory organs.
(*f*) Circulation.

(*a*) *Mode of Occurrence, Formation of Tube, &c.*—Most of the animals examined were found in a limestone of recent origin which occurs on the shore and on the sea-bottom in False Bay. It contains a large quantity of rounded sand-grains embedded in a calcareous matrix, which is made up of recent shells. It is bored through by worms, lamellibranchs, and sponges. It seemed at first pretty conclusive that the Phoronis had bored into this limestone, as, in most of the cases, where they were chiselled out or the limestone broken, they were found to fit closely the cavities in which they lay, and as the tubes were coated on their outside with a layer of sand-grains apparently pushed aside when the limestone itself was dissolved. The presence, however, of numerous sponge spicules in this coating of the tube seemed to indicate that the cavity had originally been made by a sponge. Further, the fact that other specimens were found in the interstices of Polyzoa and worm tubes, in one case in the tube of a Serpula which had left or been ejected, and in another case in the loculi of the base of a barnacle shell, is evidence in the same direction. I may add also that no acid reaction was obtained from living specimens. On the whole, the balance of evidence seemed to indicate that this Phoronis is not a limestone-boring animal, and that colony formation, which, however, is not a very characteristic feature of this species, is merely due to local conditions favouring growth at a particular point.

The part of the tube projecting from the material in which the animal occurred varies much in length, being usually about 4 to 6 mm., but sometimes much longer, or entirely absent. This part of the tube was very flexible, and covered with a substance similar to that of its surroundings. The stone was found to be covered with a greyish coating of *débris*, held together by a sticky substance. On one or two occasions large starfish, which were in the tank, were observed to remain for some time in the stone and clear off this coating without, however, injuring the Phoronis. It would appear that this coating may be produced by the action of the Phoronis themselves. Sections of the projecting part of the tube showed that the *débris* was not only adherent to the outside of the tube, but was included in the substance of the tube itself. For the probable origin of this mucous substance and particles, see below. In some species the foreign substance adhering to the tube has been described as the

excreta of the animal. In this species the excreta were observed to be ejected in long, solid, cylindrical masses, falling clear of the animal and tube. Growing on the tube were often to be observed solitary stalked Protozoa with horseshoe-shaped nucleus.

The exposed part of the tube was readily injured, and occasionally individuals were seen protruding through an aperture in the injured tube.

The substance of the tube was semi-transparent, brownish, and of a tough consistency where embedded; in this region there were no inclusions in the substance of the tube. There was evidence that the tube is secreted by glandular epithelium of the body generally. Thus, if the animal is removed from the tube, there is an active secretion of mucus, which soon causes the body to be covered with any loose particles that may be in the neighbourhood. In one case a fairly large active copepod was observed to become entangled in the viscid secretion, and was soon rendered quite helpless. The mucus is at first clear and transparent, but soon becomes whitish and opaque.

None of the tubes were straight, but had a more or less irregular curve, sometimes even forming a loop. When tubes were removed from the limestone by decalcifying, they were found to be densely coated with firmly adherent quartz grains, not arranged in any definite manner. These sometimes deeply indented the substance of the tube and the body of the animal. The posterior end of the animal apparently exercises some penetrating though not boring function.

The body of the animal varied much in diameter according to the extent to which it was protruded. Under certain conditions, which could not exactly be determined, the animals were greatly extended from the tube. The body and tentacles were then mostly rigidly extended. They sometimes slowly rotated in themselves—both lophophore and body—but did not, as described for some species, bend or wave from side to side. This latter movement was sometimes observed, however, when the animals were under observation in small vessels, especially when being examined by transmitted light.

Tentacles, Muscular and Ciliary Movement, &c.—The method at first adopted in microscopic examination of the living animals was to remove it from its tube by cutting away the limestone, or to suddenly cut off a protruded head, when after a time it often again expanded fully. The tentacles were then observed to be well provided with long cilia (about one-fourth the diameter of the tentacles). In these cases, however, the cilia were never observed to be in motion

(*cf.* van Beneden's observations (**2**), in which he describes the cilia as non-motile).

Other observations were then made on animals projecting over the edge of the stone so that transmitted light could be used. In this case the cilia were observed to be very active, though, if the animal were disturbed, they suddenly ceased before the animal withdrew into the tube. On one or two occasions the cilia were observed to remain at rest when the undisturbed animal was fully extended. Expansion of the lophophore was not as described in some species, viz., after the extension of the body, but the tentacles began to spread out at the very commencement of the protrusion.

The currents of water were best observed under the microscope. It was found that what might be called the inset current, as is to be expected, was into the space between the outer and inner circle. Particles in suspension in the water were carried into this region even from a distance equal to the length of the outstretched tentacles. The particles, especially the larger, were carried to the mouth on the tentacles, evidently by the active cilia. It was surprising, however, to find that in many cases, after reaching the base of the tentacles or margin of the mouth region, the same particles were returned on the same tentacles, and travelled as rapidly in the opposite direction to the distal end of the tentacle. The tip of the tentacle was then slowly bent backwards, and the particle dropped off on to the stone, the cilia at this part of the tentacle during the process ceasing all movement. In such cases the particle was observed to have a coating of mucus, by a thread of which it often hung on to the tentacle for a time. In a few cases the particles were dropped off in the same way without first travelling to the mouth. This was observed to occur not only in the outer circle of tentacles, but also in the inner, in which case they were dropped into the centre of the inner circle when there was a constant and very strong current passing upwards and away from the animal. The disposal of particles in this way seemed as much a function of the cilia as the conveying of them to the mouth. I at first supposed that it was effected by a reversal of the movement of the cilia, but this was never observed. It was afterwards observed, however, that if a tentacle be carefully examined, looking towards it from the direction of the mouth region, the cilia on each side showed the ciliary movement in opposite directions.* This occurred on all the tentacles, both those of the inner and outer row. The apparent movement may best be described as upwards on the left side and downwards on the right of

* I do not know whether such ciliary motion has been recorded in any of the Polyzoa, but I have observed it in some.

each tentacle when it is viewed from the oral side of the animal and with the lophophore fully expanded. The result would be, of course, that particles, in contact with the one side only, would be carried in a direction outwards or inwards, and opposite to that of the apparent motion of the cilia (due, of course, to the slower stroke in that direction). The cilia on either side could be brought into contact with the particles by rotation of the tentacle, which was observed in a few cases to occur, but this point was not conclusively established, as exact observations are not here easily made. It is certain, however, that the propulsive action of the cilia is not only towards the mouth, as has been supposed, but is largely concerned in carrying away any rejected particles. Particles of a diameter about equal to a sixth of that of the tentacle, and larger, are carried off in this way, as are also irregular masses of *débris* that may be caught up in the inhalent current. Smaller particles are got rid of in another way. If an actively feeding animal be viewed laterally, so that the outer and basal part of the tentacles is seen, a large number of particles is observed to be escaping between the bases of the tentacles over the edge of the "membrane" connecting them, and then to fall in a continuous shower on to the edge of the tube, to which some were observed to adhere (probably the origin of the inclusion seen in the substance of the protruding part of the tube).

Another and different action of the tentacles was observed when the animal was feeding actively. This was a sudden bending in towards the mouth of the distal free end of the tentacle both of the inner and outer row (*cf.* fig. 1, in which one tentacle of the outer row shows the nature of this bending). Single tentacles, independently of the others immediately next them, showed this movement, which was sharp and definite both in the action and recovery to the normal position. At times this movement was repeated by different tentacles at very short intervals, and in the case of Phoronopsis, in which this movement was more marked, on several occasions it appeared as a quite continuous jaculatory movement all round the lophophore. It might be suggested that the result of this movement is to throw or sweep particles of food towards the mouth, but only in a few instances was this actually seen, and the possibility is not excluded that these cases were accidental. This movement might be compared to the reaction on stimulus of the tentacles of some sea anemones and polyzoa.

The inhalent current, which sets in towards the mouth region, passes off in two directions, viz., between the outstretched tentacles of the outer row and downwards, and between the tentacles of the inner row and inwards, where there is formed a very strong current

upwards, stronger than the inhalent current (being more confined). It might be expected that a part or all of this current would also flow out over the anus and nephridial openings by the large space which forms the open part of the horseshoe-shaped lophophore, and, indeed, Masterman (**6**), who, however, had not the living animal, describes and figures such a current as existing. If the living animal is carefully observed, however, it can be seen that not only does no such current exist, but that there is a current leading inwards not outwards at this aperture, so that it passes first over the two pillar-like sides of the lophophore which are characterised by the special development of nervous tissue at this place, then over the nephridial openings and the anus, and joins the strong exhalent current of the inner circle of the lophophore. Benham (**2**) has accurately described this patch of nervous tissue, and regarded it as structurally the only approach to an appearance of a sensory organ in Phoronis, but expresses his doubts on account of its proximity to the excretory openings. The existence of such a current of water however, passing in turn over the nervous epithelium, the renal openings and the anus, removes this objection, and renders the case quite similar to that of the current, for instance, in the palleal chamber of some Mollusca, which passes first over the osphradium, then the renal aperture, and finally the anus. It has been repeatedly observed that the animal seems very sensitive to the condition of the water in which it lives, and I cannot but think that the two special patches of nerve tissue represent a sensory organ similar in function to the osphradium of molluscs, and it may be called for want of a better name the olfactory organ.

Still another movement may be observed, but with greater difficulty. It occurs on the upper part of the body just below the insertion of the lophophore. No current of water was observed, but merely a movement of particles apparently entangled in mucus and in contact with the body. These were slowly carried upwards away from the mouth of the tube. Very small cilia were on occasions observed. This action may account for the fact that no foreign particles, such as might fall into the tube, were found included in its substance where embedded in the stone.

Eggs, Larvæ, Oviposition, Breeding Season, &c.—The eggs and embryos are very conspicuous, and could be readily observed mostly within the lateral bends of the inner circle of tentacles though occasionally projecting outside these bends. Those nearest the body were apparently held together by the mucus which is secreted by the glandular part of the lophophoral organ; those near the free ends of the tentacle were further developed, some attached to the

tentacles and still in the delicate egg capsule; others, however, were in some cases observed to have hatched out, and to have reached the stage at which the pre-oral hood and the body formed two approximately equal portions. Some embryos at this stage were observed to exhibit a fairly active opening and closing motion of the two limbs thus forming (pre-oral hood and the body), suggesting that the relatively large development of the hood at this stage may have an important physiological function (respiration? attachment? nutrition?).

The discharge of the ova from the body and lodgment in the brood chamber can readily be observed. Throughout the whole breeding season of about 11 months eggs could be seen in the particular group under observation at any time, in one or other of the specimens, passing up the body cavity singly or in rows of usually about 6 or 8. If a specimen projecting over the edge of the stone (so as to allow of microscopic examination by transmitted light) be examined, the movement of the eggs upwards in the body can readily be observed. At each expansion of the blood vessel from below upwards the eggs or row of eggs was shifted a little further towards the nephridial opening, and on the contraction and emptying of the blood-vessel they were carried back again, though not so far. No evidence of any slow forward movement, such as might be caused by cilia, was apparent. In a typical case the eggs were observed to pass in this manner from the point in the body where it projected from the tube upwards to the nephridial duct in about 10 minutes. Here they became grouped together, remaining thus for 6 minutes. One of the eggs was then seen assuming an elongate slightly bent form (apparently entering the nephridial tube). It was then observed to travel upwards slowly and at a uniform rate inside the nephridial tube which was closely applied to the base of the lophophore. The nephridial tube was then apparently elongated, its opening being covered by the leaf-like part of the lophophoral organ so that on its escape from the opening of the duct the egg was safely carried upwards to the base of the brood pouch and took its place along with the others. It here again assumed a circular form, 0·22 mm. in diameter. Almost immediately after the discharge of the ovum by one nephridial duct the same process took place by the other duct, and so on alternately till all of the group of ova were discharged (in about 15 minutes).

At the upper end of the mass of developing eggs the larvæ were well advanced. In a larva which was observed escaping no trace of tentacles was seen (*cf.* Longchamps' observations (**8**)). In one or two cases the larvæ were observed swimming about freely, but

retained by a bending in of the tips of the tentacles of the inner circle.

In the particular group of animals under observation nearly all the individuals carried eggs and larvæ when first found in the beginning of May. A few had them up to the end of June. On November 10th one specimen was observed to have an egg in the body, and by the 20th of the same month more than 90 per cent. had conspicuous clusters of eggs and larvæ in the tentacles. The comparatively sudden and simultaneous appearance of these was somewhat striking.

Soon all of the specimens bore eggs and larvæ, and this continued up to about the beginning of March of the following year, when a few were seen without them. By May 12th none of the group under observation had eggs. In some of the individuals which were more carefully watched a peculiar occurrence, for which I cannot suggest an explanation, was observed. The animal which had remained with body and lophophore with its egg mass fully extended for months, totally disappeared, leaving only the projecting tube. This seemed a confirmation of the suggestion of the annual dying off of the Phoronis. A few days (8–10) afterwards, however, the same animal was observed projecting (to a less extent) from the tube, but the lophophore was much smaller, the tentacles being only about two-thirds their former length and without eggs.

Lophophoral Organ, Lophophoral Gap, Epistome.—From the observations just described on the method of discharge of ova, it is apparent that the projecting leaf-like fold of the lophophoral organ acts in such a way as to form a closed passage from the aperture of the nephridial duct to the brood cavity, the glandular part supplying the mucus in which the eggs are enveloped and bound together. The whole organ might be described, therefore, as a glandular oviducal furrow.

Contrary to what has been observed in other species, I have not found this organ absent in any specimen with eggs, though sections of a large number of individuals might show that this is true of *P. capensis* also.

The lophophoral gap between mouth and anus has received a good deal of attention, and there has been some speculation as to its function. It is a very striking opening in the circle of tentacles as seen in sections, but it does not exist as such in the expanded living animal, in which the gap is no larger than the spaces between the tentacles. This will be made clear from fig. 1, which is from the living animal. It seems quite out of the question that the inhalent current of water directed by the

epistome escapes by this "gap" into the inner circle as has been suggested (Masterman (**6**)).

It is merely the point of origin of the tentacles, which in this region are of all sizes; two sometimes scarcely projecting have been seen at each side touching each other across the "gap," and following these 5 or 6 on each side rapidly increasing in length till they join the fully developed tentacles of the inner circle. These smaller tentacles on each side often overlap at their tips, preventing any wide opening between the regions of the inhalent and exhalent currents.

The contraction of these small tentacles and of the tissue in the neighbourhood of the gap, along with the approximation of the tentacles in preserved material, doubtless bring about the appearance of a large gap in sections of this region.

The epistome could be readily observed in the living animal in certain positions. In contrast to the other organs of the body it showed a constant and active movement. This occurred at its free edge. Observations were, of course, only possible when the lophophore was fully extended. In this condition the epistome was usually held back against the inner circle of tentacles, the mouth being widely open. Occasionally, however, the epistome descended over the mouth, closing or partly closing it. Various suggestions have been made as to its action, directing the currents of water (Masterman (**6**)), preventing a direct passage between mouth and anus through the lophophoral gap (Benham (**2**)). These, though quite justifiable deductions from a study of sections, do not seem probable in view of what has been noted above with regard to the behaviour of the animal in the living condition. So far as observations went, the function appeared to be the obvious one of closing the mouth, and its lateral extension on each side; it is doubtless also partly sensory.

Circulation.—Though the closed vascular system with red blood of Phoronis is one of its most striking characteristics, there is still some doubt as to whether there is actual circulation or merely oscillation of the blood. This is probably to be accounted for by the difficulty in obtaining accurate observation of the course of the blood. In a recent paper Enriques (**5**) describes a unique type of circulation which he has observed in *Phoronis psammophila.* He was enabled to examine the circulation microscopically by removing the animal from its tube by a method which he considers would not injure the animal to such an extent as to upset its normal circulation. Briefly, his conclusions are that there is an oscillatory movement of the blood plasma, and that, during this process, the

corpuscles accumulate in the distal or lophophoral region, from which they are finally expelled by a strong contraction of the median vessel into the general vascular system, there being thus a circulation of blood corpuscles but not of plasma. I have also observed something similar to this in specimens of *P. capensis* which have been removed from their tubes, and also similar movements in the vascular system of individuals which have thrown off the lophophoral region, with the exception in this case, of course, that the blood corpuscles, while accumulating at the distal or regenerating end, cannot pass off again by a circulatory movement into the system.

I cannot but suspect that these interesting phenomena observed by Enriques, are mainly due to injury or irritation produced in removing the animal from its tube, and might be compared from their mechanical aspect at least to clot formation.

The method adopted in making the following observations was to select for microscopic examination specimens projecting over the edge of a piece of stone so that they can be examined by transmitted light. The animals sooner or later began to expand, often to a very considerable extent, and an account of their habit of occasionally rotating slowly in the tube, first in one direction then in another, presented different aspects of the vascular system. The method is rather tedious, but probably ensures normal results.

On the first protrusion of the tentacles, the movement of the blood was readily observed in a few, and, in full expansion, blood was seen to course up and down in all the tentacles. The intervals between such pulsation varied much (4–10 seconds). The inflow of the blood into the blood-vessels of the tentacles was slow, and apparently caused by pressure from behind; the outflow was more rapid and apparently caused by contraction of the vessels.

The inflow and outflow of blood was never synchronous in all the tentacles, but was irregular, though occasionally a few neighbouring tentacles showed pulsation at the same time. Each of the blind tentacular vessels opened into a common circular vessel in which the course of the blood was sometimes in one direction, sometimes in another.

Two such circular vessels were seen lying not far from each other. These were, however, not recipient and distributing vessels such as occur in *P. australis* (**2**), but were merely the single connecting or circular vessels of the inner and outer circle of tentacles. In both, the movement of the blood was to and fro without any regularity. The outer circular vessel was continued round on the oral side, but the inner circle was interrupted at this point thus .

The blood flowed away from each side of the lophophore, from the right by a vessel which passed round by the oral region and joined that from the left to form the large vessel on the left side of the descending limb of the alimentary canal. In all these there was observed to be an almost continuous stream of blood downwards away from the lophophoral region.

As in some other species, the efferent vessel at a little distance from the lophophoral region gives off a number of blind vessels into the body cavity. These were occasionally very distinctly seen in the living animal, and were then observed to be contractile, receiving blood from the main vessel and expelling it exactly as in the case of the tentacular vessels.

The tentacular vessels apparently expelled the blood by contraction. It would be difficult to say if the circular vessels were contractile. The vessels by which the blood leaves the lophophoral region were not contractile (*i.e.*, the vessel on the left side of the alimentary canal and its two branches).

The centrally placed vessel between the ascending and descending limbs of the alimentary tract showed, however, a very marked contraction from below upwards. This was observed to occur, always in the same direction, through the entire course of so much of the vessel as could be seen (sometimes 10 mm.) under normal conditions, without removing the animal from its tube, in which case the movement was abnormal. A large volume of blood (corpuscles and plasma) was seen to be thus conveyed to the lophophoral region and to pass to either side by two short branches of the main vessel. Each of these branches opened directly into a vessel which seems capable of great expansion, and is lodged in a cavity of the lophophore very apparent in section. The blood passed into the tentacles in its immediate neighbourhood, and to the tentacles further removed by the circular vessels. There was no evidence of any true circulation through the tentacles nor of circular distributing and recipient vessels, the whole of the blood-vessels of the lophophoral region being merely a complex form of the simple blind vascular diverticula seen on the large vessel within the body. The greater part of the stream of blood thus never entered the tentacles, but passed on directly to the two branches of the efferent vessel which joined each other to form the single vessel situated in the left side of the descending limb of the alimentary canal. There was thus a true circulation, the blood being driven forward by a vessel lying over what in Phoronis corresponds to the dorsal aspect of the alimentary canal. On reaching the anterior end it passes by two vessels round the alimentary canal (*cf.* the "hearts" of annelids) which join to-

gether on the left side (ventral ?) of the alimentary canal to form the efferent vessel. This passes downwards and joins the contractile afferent vessel, by which the blood is again driven through the same circle. Blind diverticula occur in the course of this vascular system, viz., the tentacular vessels, a group of vessels floating freely in the body cavity some distance below these, and finally a number of vessels penetrating the gonads at the other end of the body.

The intervals between the contraction of the dorsal vessel were very uniform in any one individual under observation, but varied much in different individuals. In some they were three seconds, in others as much as ten. They appeared also to differ in the same individual at different times.

If the movement of the blood be carefully observed in a favourable position of the animal it is found that after each contraction of the dorsal vessel is completed there is a very slight return of the blood in its upper part, the quantity returned however being infinitesimal as compared to the large volume passed upwards, and it is only in the upper part of the afferent vessel and carried forward again in the next flow. The same thing happens in the commencement of the efferent vessels. This may be expressed more definitely in the time observations in a particular case. Thus in one case the interval between the contraction of the dorsal vessel was ten seconds. In the afferent vessel the flow of blood continued from the first to the sixth second, in the seventh and eighth there was complete contraction and emptying of the vessel (both of corpuscles and plasma), in the ninth and tenth there was a slight return of blood in the upper part of the vessel. The efferent vessel was never without blood corpuscles. A more decided flow began in the second second and lasted till the eighth, and between such intervals there was a slight return.

The lumen of the afferent vessel is less than that of the efferent, but the proportions of blood corpuscles to plasma in each seemed the same. The peristaltic contractions of the dorsal vessel were always towards the free or lophophoral end of the animal in normal conditions.

In injured or regenerating animals there is an oscillatory or to-and-fro movement of the blood in the afferent and efferent vessels, and often a crowding together of blood corpuscles into patches which remain stationary for a time in the free or distal region of the body.

III.—PTYCHODERA CAPENSIS, sp. n.

I have from time to time, in shore collecting, found specimens of this Enteropneust chiefly at or near low water, and generally in coarse sand or gravel. It appears to belong to a species not hitherto described, and, in recording its occurrence in this region, I add a brief description of its external features, which I hope to supplement at a later date by anatomical details and a figure of the animal.

The length of the specimens procured varied from about 80 to 130 mm. in the normal expanded condition. Individual specimens, of course, varied much at times when disturbed, but when left in fresh sea-water and coarse sand seemed to assume about the same proportion. The relative size of the various regions of the body did not vary much. Even the caudal region, which in other species has been found to vary so greatly, was in these specimens about the same proportionate length, probably owing to the fact that this species does not show the tendency to break up so markedly as in other species. Some imperfect specimens were procured, but they seem to have been injured in the securing of the animals. None of the specimens kept alive or preserved were observed to break up.

Proboscis.—The proboscis is of the usual size and shape. It was mostly somewhat longer than broad, egg-shaped, slightly tapering to the anterior end. When prying among the sand and shells, it was somewhat longer and often bent in various directions. A slight notch occasionally appeared on its posterior dorsal surface. In some conditions the longitudinal muscles of the proboscis were seen in distinct bundles.

The colour of the proboscis was pale chrome-yellow, uniform, except when this organ was expanded so that the longitudinal muscles appeared as distinct stripes.

Collar.—The dimensions of the collar were also normally fairly constant, its length being usually equal to that of the proboscis. Its breadth was slightly less than its length, being narrow in the middle. The free anterior margin was always somewhat folded. This region, which occupied nearly a half of the total length of the collar, was of a paler yellow than the succeeding part, which was in the form of a narrow ring. This was followed by a thin band of white pigment in the form of a circular streak, a little further back another thin band or yellow streak, and somewhat behind this, where the collar joined the body, another.

The collar often showed longitudinal corrugations thicker in the

middle, but none occurred between the two last-mentioned yellow streaks. No distinct circular furrow was seen in this region in the living animal.

In one living specimen, which happened to have the lip of the collar widely expanded, the two legs of the skeleton were seen lying at an angle of about 50° to each other. In the apex of the angle was observed what appeared to be a small opening—apparently that of the "notochord."

Genital Wings.—These were well developed both in length and breadth. Their greatest breadth was at the posterior end of the gills. It was, when spread out, a little over twice the length of the proboscis. The posterior extremity could not be exactly determined, as from this point they gradually diminish in size and lie alongside the hepatic coeca as mere ridges. The place of transition from distinct folds to ridges is about the middle of the hepatic coeca. Here also the brilliantly coloured gonads ended in most specimens. There was, however, no abrupt transition, as in some other species. The free edge of the genital wings are always in contact with each other where they join the collar. They are transparent throughout, in marked contrast to the gonads. Towards the body they meet each other above the intestine behind the gills, and this region is also clear and transparent. A fine genital streak (apertures of the gonads) occurs along the centre of each, and is of a dark reddish colour, the colour of the gonads themselves being a bright yellow. The genital folds usually met each other dorsally over the body, though often folded outwards, so as to expose the gills; their point of origin is the dorso-lateral region of the body.

Gills.—The gill region is comparatively small, being equal to the combined length of the proboscis and collar. This length did not vary in any of the specimens examined. In breadth it was fairly uniform till near the posterior end, when it abruptly tapered off to a point and was often observed to pass under the joined bases of the genital pleuræ, about one-seventh of its total length being thus hidden. At its widest anterior part it was about half the length of the proboscis. About fifty gill-slits or pores were counted in the deep furrow at each side of the gill. In the living animal the anterior of these were slit-like, being more than twice as long as broad. Towards the posterior part of the gill they became more circular, and the most posterior were almost circular, sometimes square. In preserved specimens all the openings were decidedly elongate.

Hepatic Coeca.—These are about sixty in number, and are arranged in pairs. Anteriorly they are less definite and more widely set

apart, about twelve of them being between the genital folds, by which a few of the anterior of the twelve may be hidden. Further back they are normally in pairs, one on each side of the body opposite each other, but in extensions of the body they were often seen to interdigitate, thus alternating on each side. Posteriorly they gradually diminished, the whole length of the hepatic tract being about half the length of the genital ridge, or one-third of the tail region.

In colour the hepatic coeca varied considerably, being, however, always dark brown in the central region. Anteriorly and posteriorly they were more or less light in colour, sometimes pinkish.

Tail Region.—The tail region was a little over half the total length, and did not vary much in thickness, being about equal to that of the middle of the hepatic region, which was a little over half the diameter of the collar. The most prominent feature was the presence of three lines running along nearly the whole length of the upper surface, the central one of these being the dorsal nerve chord, and one on each side being a thin yellowish streak, which commenced about the middle of the hepatic region and continued to near the extremity of the tail. In other species in which such streaks are described they are situated in a groove which passes through the "islet" like cross-bands of glandular tissue. Here, however, these bands pass over them so that epidermal furrows were absent on the dorsal surface, one of the most distinctive external characteristics of this species.

On the ventral side the yellowish ventral nerve chord occurs, and interrupts the glandular patch throughout its whole course from the collar to the anus; in contrast to the dorsal nerve it thus lies in an epidermal groove.

On the dorsal side of the tail these glandular patches of the epidermis are of no great length transversely to the body, but on the ventral side they appear almost like annulations.

SUMMARY.

(1) Phronopsis, a new genus of the Phoronidea, differing from Phoronis chiefly in having an involution of the epidermis with definitely differentiated (cubical) cells. The involution occurs below the nerve ring, which it partly covers; it passes round the body, encircling the mouth, anus, and nephridial apertures.

(2) *Phoronis capensis*, a new species, closely related to *P. hippocrepia*.

(3) In *Phoronis capensis* the following observations, some of

which are probably applicable to other species of Phoronis, have been made :—

a. Currents of water with food and other particles pass in between the outer and inner circle of tentacles towards the mouth. They pass out between the expanded tentacles, downwards between those of the outer row, and inwards and upwards between those of the inner.

b. Another current of water passes in succession over two special patches of nervous epithelium, the nephridial openings and the anal opening, and joins the last-mentioned current.

c. Most of the particles in the first current come in contact with the tentacles, and are carried on them to the mouth region ; some of these are then carried back on the same tentacles on which they came and dropped off.

d. The two special patches of nerve tissue on the nerve ring are in a position with regard to currents of water similar to the palleal olfactory organ of Mollusca and probably exercise a similar function.

e. The nervous tissue at the commencement of the digestive tract appears from the definite rejection of particles after reaching this region to be an organ for the discrimination of food particles, and may be called an organ of taste.

f. The lophophoral gap between mouth and anus is in the living and expanded animal no wider than the spaces between the tentacles, and plays no special part in the passage of currents of water.

g. The projecting free part of the lophophoral organ is relatively large and leaf-like in life, and in discharge of ova overlaps the nephridial opening conveying the ovum to the brood cavity in the tentacles. The more glandular part probably supplies the mucus in which ova and embryo are enveloped. The whole organ may be called a glandular oviducal furrow.

h. The blood (corpuscles and plasma) in the normal condition of the animal passes successively through a median (dorsal?) vessel, two circumœsophageal dilatable vessels, a lateral (ventral?) vessel, and on again to the median vessel. That is, in these vessels there is a true circulation which, however, becomes oscillatory or partly so under abnormal conditions.

i. The movement of the blood is oscillatory (to and fro) in the vascular diverticula of the tentacles, the body cavity and the gonads. It is also oscillatory in the small circular vessel at the base of the tentacles.

j. Reproduction may take place throughout the year, but is much more marked in the summer months.

k. This species does not die off annually.

(4) *Ptychodera capensis*, a new species of the Enteropneusta.

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EXPLANATION OF PLATES XVI., XVII.

Fig. 1.—*Phoronis capensis* in nearly complete expansion. The eggs are indicated in the inner circle of tentacles, the jaculatory movement of tentacles by a bent tentacle on the left, the nerve ring by white lines, and the digestive tract by a longitudinal white band.

Fig. 2.—*Phoronopsis albomaculata*, viewed from above (from a photograph of the living animal in complete expansion).

Fig. 3.—Longitudinal section of *Phoronopsis albomaculata* (specimen B), showing fold of epidermis and nerve ring. *bl.* Blood-vessel. *bt.* Basement tissue. *ep.* Epidermis of body. *ep'.* Modified epidermis of fold. *eps.* Epistome. *int.* Tangential section of wall of intestine. *lo.* Lophophoral organ. *n.* Nervous tissue. *neph.* Section of duct of nephridium.

Fig. 4.—Enlarged view of nerve ring with epidermal fold shown in fig. 3. *bt.* Basement tissue. *coe.* Coelomic epithelium. *ep.* Epidermis of body. *ep'.* Modified epidermis of fold. *n.* Nervous tissue. *neph.* Section of duct of nephridium. *ts.* Transverse septum.

Fig. 5.—Transverse section of *Phoronopsis albomaculata* (specimen A). The section is in reality oblique, as the organs of the left side were at a lower level than those of the right. Figuring as in Fig. 4 with the addition of *a.* Anus. *m.* Mouth. *nep'.* Cells of internal opening of nephridium.

Fig. 6.—Median longitudinal section of *Phoronis capensis*. *b.t.* Basement tissue. *eps.* Epistome. *m.* Mouth. *n.e.* Sub-epidermal nerve tissue of nerve ring. *n.e'.* Nerve tissue near mouth (organ of taste?). *oe.* Œsophagus. *t.* Tentacle.

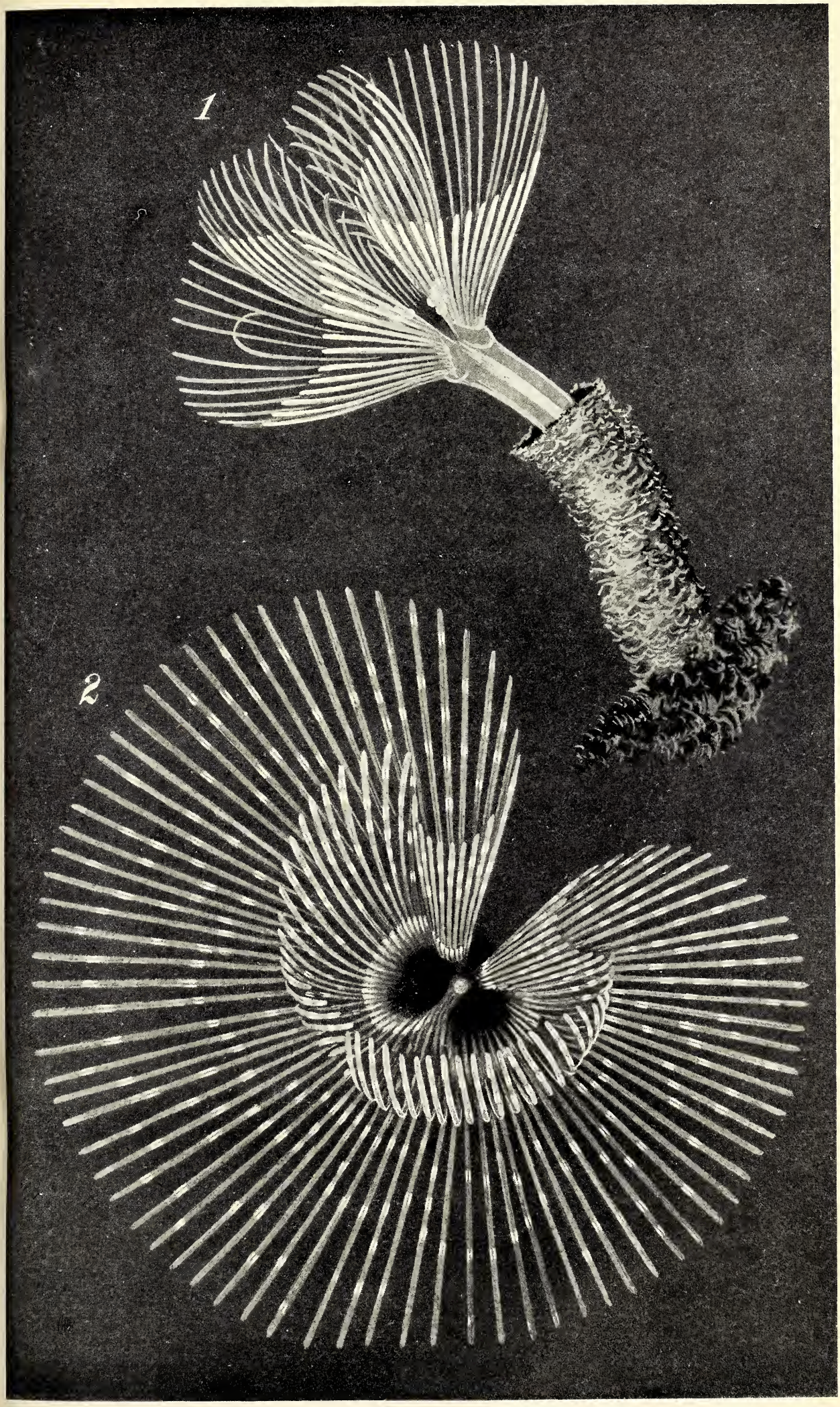
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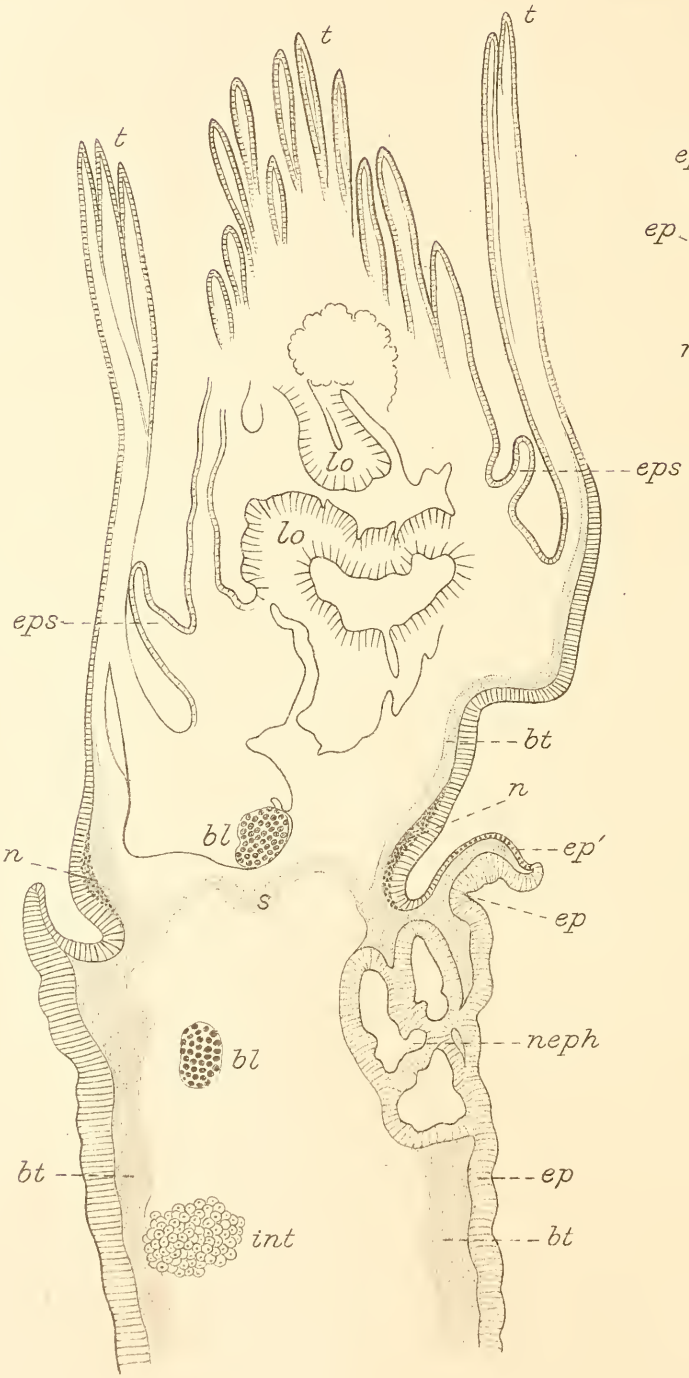
Fig. 3.



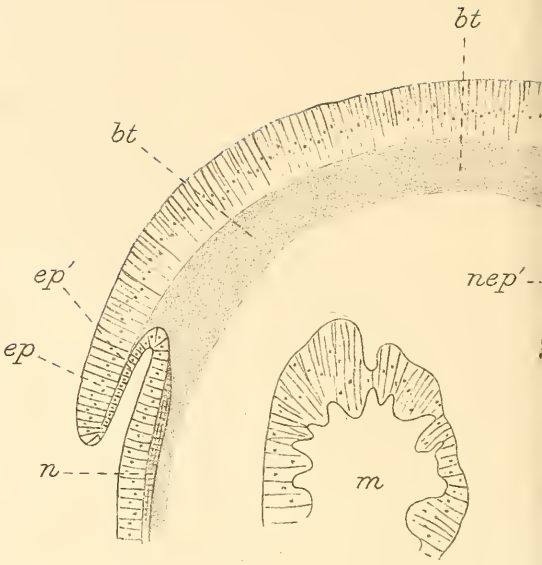
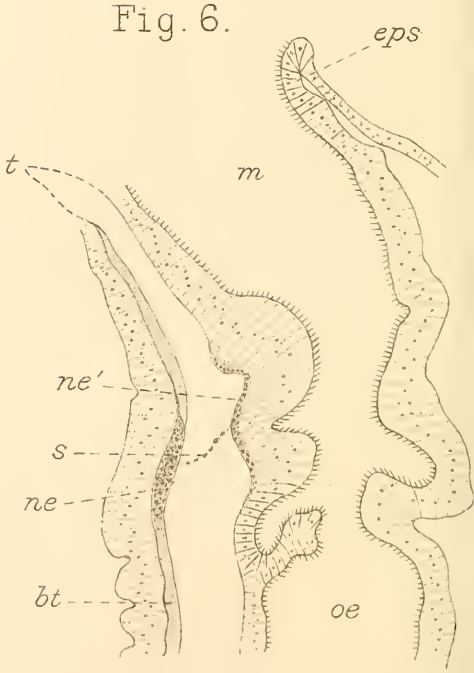


Fig. 5.

Fig. 6.



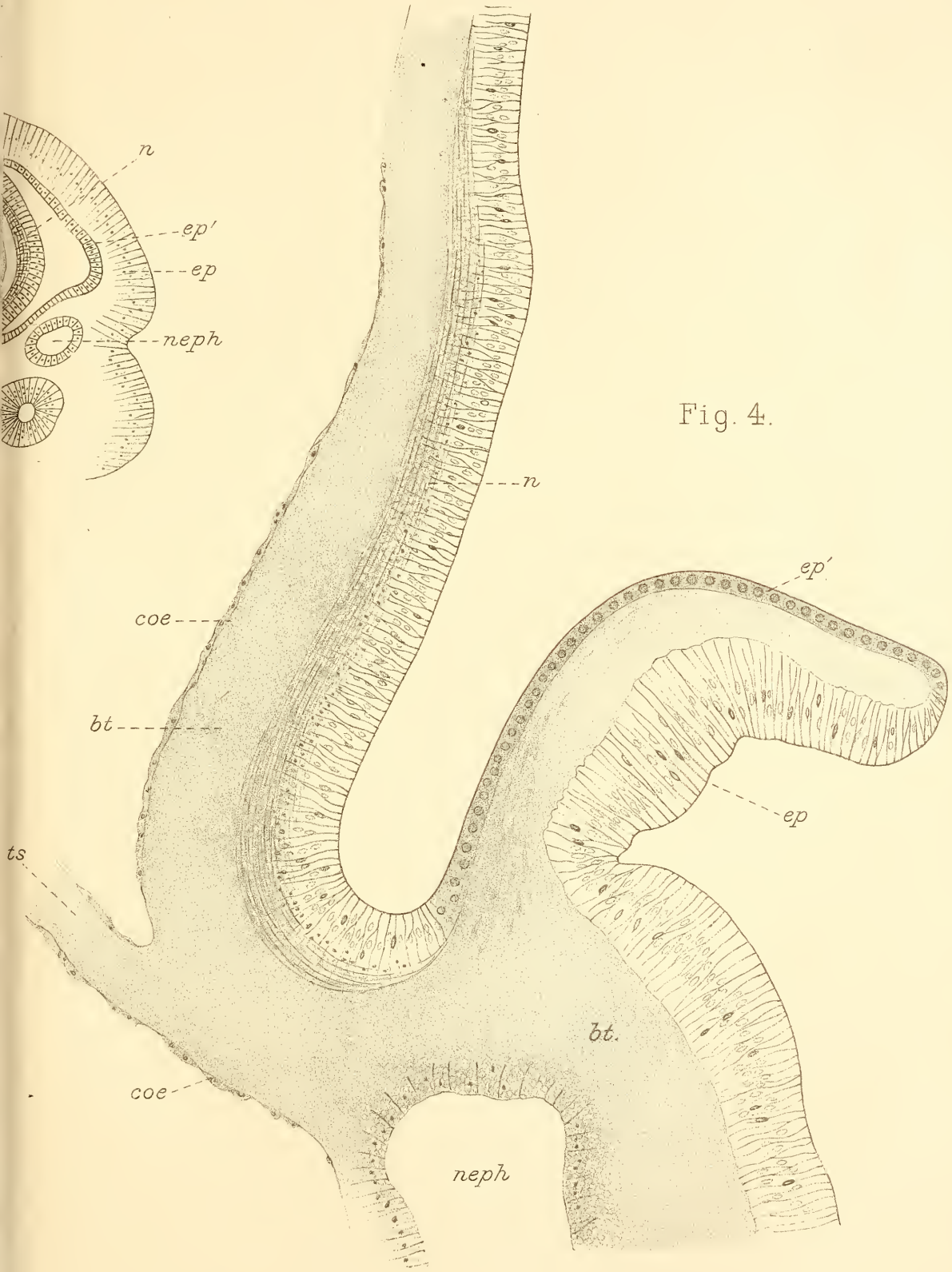


Fig. 4.

West, Newman lith.

ON A PARASITIC COPEPOD FROM *CEPHALODISCUS*.

By W. T. Calman, D.Sc.

British Museum (Natural History).

(Plates XVIII., XIX.)

The parasite dealt with in this paper was discovered by Dr. W. G. Ridewood in the course of his investigation of *Cephalodiscus gilchristi* from the Cape Seas, and is briefly referred to in his memoir on that species (Mar. Invest. S. Africa, iv., p. 181). At his request I made a preliminary examination of the specimens, and supplied him with a few notes, which are incorporated in the paper referred to. In view of the special interest of the host it seemed desirable to attempt a more complete examination of the material, and I gladly avail myself of the opportunity kindly given me by Dr. J. D. F. Gilchrist of publishing a fuller account.

Most of the specimens which I have examined were found by Dr. Ridewood in the course of his dissection of the *Cephalodiscus*, and I am indebted to him for notes on the circumstances of their occurrence. The other specimens were obtained by searching through some pieces of *Cephalodiscus*-colony which Dr. Ridewood kindly handed over to me for the purpose.

The parasite belongs to the family Ascidicolidæ, of which most of the members are parasitic in the alimentary canal of Tunicata. The fact, however, that the form to which it is most nearly allied, *Enterognathus comatulæ* of Giesbrecht, infests, not a Tunicate, but the Echinoderm *Antedon*, shows that the nature of the parasite in the present case has not necessarily any bearing on the chordate affinities of its host.

In the following account Dr. Giesbrecht's lucid and detailed description of *Enterognathus* * has been taken as a guide. The

* Giesbrecht, W., "Mitth. ü. Copepoden. 14. *Enterognathus comatulæ*, ein neuer Darmparasit." Mitth. zool. Stat. Neapel, xiv., pp. 61–79, pl. 5, 1900. Dr.

characters and affinities of the new genus which I have found it necessary to establish will be discussed later.

Family ASCIDICOLIDÆ.

ZANCLOPUS* CEPHALODISCI, gen. et. sp. nov.

Adult Female.

(Plate XVIII., figs. 1–8.)

Total length, ·55–·62 mm.

The body is stout and maggot-shaped, about $3\frac{1}{2}$ times as long as wide. The integument is thin and membranous, and the segmentation, especially in the abdominal region, is very obscure. The five thoracic somites are defined by deep constrictions and overlap a little at the sides, but do not form collar-like folds on the dorsal surface as in *Enterognathus*. The thoracic limbs, with the exception of the fifth pair, are articulated on the ventral surface of the body, and are almost invisible when the animal is viewed from above. The head is slightly narrowed in front, and there is a blunt, deflexed rostrum, only visible from beneath (fig. 4). Posteriorly the body tapers gradually, without any marked constriction. The genital somite is very short and is obscurely defined from the somites in front and behind. The openings of the oviducts are lateral in position (fig. 6). The copulatory pore was not observed. The following four somites are rather obscurely separated. The furca (fig. 6) is short, the rami not much longer than wide, each terminating in four short spiniform points directed outwards.

The antennules and antennæ (fig. 4) are short, thick, and not distinctly segmented. The former have each a single terminal seta and a minute seta on the posterior edge.

The mouth-cone (fig. 5) is not very prominent. The lower lip has large lateral lobes. The mandibles each end in a scythe-shaped blade projecting between the upper and lower lips. No trace of a mandibular palp could be detected.

Immediately behind the mouth-cone on each side is a rounded

Giesbrecht has overlooked the fact that *Enterognathus* was figured (but not named) many years ago by Prof. W. C. McIntosh ("Observations on the Marine Zoology of North Uist," Proc. Roy. Soc. Edinburgh, v., p. 611, fig. 5, 1866. The figure is reproduced in the same author's "Marine Invertebrates and Fishes of St. Andrews," 1875, p. 140).

* From ζαγκλον, a sickle, and πους, a foot, in allusion to the sickle-shaped claws on the thoracic feet of the female.

prominence bearing a single terminal seta (fig. 4, *mx''*). A comparison with *Enterognathus* suggests that these prominences probably represent the second maxillæ. No other mouth-parts appear to be present.

The first four pairs of thoracic feet (figs. 7 and 8) are similar in form. The protopodite is more or less distinctly divided into two segments, of which the distal bears externally, in the first three pairs, a fine seta. The basal part of the exopodite is not distinctly defined from the protopodite; it has, on the inner edge, a minute seta which is largest in the third pair and seems to be absent from the fourth. Distally, the exopodite ends in a sickle-shaped claw, at the base of which a small segment can in some cases be detected. The endopodite is apparently unsegmented, and forms a broadly ovate or nearly circular leaflet, bearing four small blunt papillæ on its distal edge.

The feet of the fifth pair (fig. 6) are large ovate plates attached to the side of the body and pointing backwards. Two very minute setæ were observed on the distal margin of each.

Male in Fifth Copepodid Stage.

(Plate XIX.)

Total length, ·6 mm.

The general shape is *Cyclops*-like, rather elongated, the greatest breadth being about $\frac{1}{4}$ of the length. The fifth thoracic somite is distinctly narrower than the fourth. The head is about $\frac{1}{4}$ of the total length, bluntly pointed in front, with a deflexed rostrum as in the female. The pleura of the head-region are not bent inwards as they are in the adult male of *Enterognathus*. The first three somites of the abdomen (fig. 14) diminish successively in length; the fourth is as long as the first, and beneath the cuticle can be seen the division between the fourth and fifth somites of the adult. On the ventral surface of the genital segment are the genital valves (fig. 14, *g.v.*), each truncate posteriorly and bearing two setæ. The furcal rami are longer than in the female and each bears six spines; the inner spine is set on the dorsal surface, the outer one is minute, and the terminal four, of which the second is the largest, are stout and strongly curved outwards.

The antennules (fig. 12, *a'*) have a very delicate external cuticle which does not seem to show any segmentation proper to this stage, but within which can be seen, in the specimen examined, the seven segments of the succeeding (adult) stage. They are beset with fairly numerous simple hairs but no æsthetascs were observed. The

antennæ (fig. 13) are composed of three segments and have two, perhaps three, terminal claws.

The mouth-cone (fig. 12) with the mandibles (*md*) and the maxillary prominences (*mx''*) are exactly as in the female, except that the last-named structures seem to have no terminal setæ.

The first four pairs of feet (figs. 15–17) have the protopodite indistinctly divided into two segments, the distal one bearing, in the first three pairs, a seta on its outer edge. The rami of the first four pairs are each composed of three segments. The distribution of their setæ is shown by the following table, drawn up after the plan followed by Dr. Giesbrecht :—

	Re 1.	Re 2.	Re 3.	Ri 1.	Ri 2.	Ri 3.
1st Foot...	1Se 0Si	0	2Se 1St 3Si	0	0Se 1Si	1Se 3Si
2nd Foot	1Se 0Si	1Se 1Si	2Se 1St 4Si	0	0Se 2Si	1Se 4Si
3rd Foot...	1Se 0Si	1Se 1Si	2Se 1St 5Si	0	0Se 2Si	1Se 5Si
4th Foot...	0	1Se 0Si	2Se 1St 5Si	0Se 1Si	0Se 2Si	1Se 4Si

The feet of the fifth pair (fig. 14, p^5) consist each of two small papillæ, of which the inner is the larger, each bearing a single seta.

Younger Stages.

Specimens of younger stages were occasionally found, but on account of the very indistinct segmentation of the body and limbs it was not possible to refer them to the various larval stages recognised in the Copepoda. The youngest stage observed is represented on Plate XVIII., fig. 9. The total length is about ·36 mm. The fourth pair of feet are present as bilobed prominences, and the abdomen is divided into two segments. The first three pairs of feet (fig. 10) have both rami in the form of ovate leaflets, the exopodite with four spiniform points on its distal margin ; the second of these points, from the outer side, is larger than the others, and probably represents the single curved claw of the adult female.

Mode of Occurrence and Probable Life-history.

All the specimens were found in the stomach of adult zooids or nearly full-grown buds. The degree of infection varies in different colonies, or perhaps in different branches of the same colony. In some of the pieces of *Cephalodiscus*-colony which I examined nearly every adult zooid contained one or more parasites, but in other pieces they were much less abundant. The position generally occupied by the parasite in the stomach of its host is shown in

Plate XVIII., fig. 1, but it appears to be a matter of indifference whether the head or the tail is directed towards the anterior end of the stomach.

The adult females are most common, and in every case only a single one of these occurs in one host. The eggs were never observed attached to the body, but isolated eggs, or packets of eggs, were sometimes found free in the host's stomach. The number of eggs deposited at one time appears to vary somewhat. Two packets of two each, two packets of three, and from three to five isolated eggs were observed on different occasions. The diameter of an egg is about ·12 mm. Of the larval stages, two, three, or four specimens occurred together in one stomach, accompanied or not by an adult female. No adult male was found, and from the analogy of *Enterognathus* we may assume that this stage is free-swimming.

In several cases it was observed that zooids containing specimens of the parasite had well developed and apparently ripe gonads, so that there would appear to be no "parasitic castration" of the host.

It is not altogether easy to reconstruct from our observations the probable life-history of the parasite. From the relatively large size of the eggs it may be assumed that hatching takes place at a late stage of development. On two occasions specimens in a stage corresponding to that shown on Plate XVIII., fig. 9, were found in the act of escaping from a membranous investment which appeared to present no trace of appendages, and was at first regarded as the egg-membrane. The fact that from two to four of these young individuals always occur together seemed also to suggest that they were hatched *in situ* and had to pass through a free-swimming stage before entering each a separate zooid of the host to become adult females. Further search, however, afforded no evidence of any break in the series of forms, all of them plainly incapable of locomotion, connecting these young stages with the adult. As it seems necessary to assume the existence of a free-swimming stage at some period of the female's life-history (the male is probably, as already stated, free-swimming when adult) there can be little doubt that the earliest stages observed are preceded, as in *Enterognathus*, by a free-swimming stage in which the larvæ pass from one host to another. As in *Enterognathus* also, the females probably emerge temporarily from their hosts when sexual maturity is reached in order to be fertilised by the free-swimming males. On again becoming endoparasitic they each select a host which does not already harbour a parasite.

Systematic Position.

Although it has not been possible to ascertain some important characters, such as the condition of the copulatory pore in the female, the parasite described above agrees sufficiently well with the definition of the family Ascidicolidæ as given by Canu,* and resembles with sufficient closeness several types included therein, to leave no doubt that it must be referred to that family. It appears hopeless, in the present state of our knowledge of the parasitic Copepoda, to look for an exact diagnosis either of the family or of its constituent genera. At the same time the new species is so distinct from any of those hitherto described that it appears impossible to avoid the establishment of a new genus for its reception. In the vermiform, or maggot-shaped, body and non-natatory thoracic feet of the female and in the absence of a brood-sac and of maxillipeds it approaches the genera *Enterocola*, *Aplostoma*, *Enteropsis*, and *Enterognathus*. From all of these except the last it is distinguished (in the female sex) by the strongly-hooked exopodites of the first four pairs of thoracic feet. From *Enterognathus* it differs in the less strongly-marked segmentation of the thoracic region, of which the somites do not overlap dorsally, in the indistinctly segmented appendages, the reduced and palpless mandibles, the vestigial non-prehensile second maxillæ, and in the absence of the first maxillæ. In the last-named character it agrees with *Aplostoma* and *Enteropsis*, differing from both, however, in the structure of the mandible, second maxilla, and thoracic feet, and in many other details.

* Canu, E., "Les Copépodes du Boulonnais." Trav. Stat. Zool. Wimereux, vi., p. 186, 1892.

EXPLANATION OF THE PLATES.

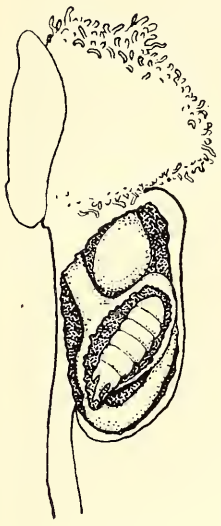
Plate XVIII.

Fig.

1. Polypide of *Cephalodiscus gilchristi*, partly dissected to show the position of the parasite *Zanclopus cephalodisci* in the stomach. One of the gonads of the host is seen immediately above the stomach.
2. Adult female of *Zanclopus cephalodisci*, from above.
3. The same, from the side. The abdomen is generally bent dorsally in the position shown here.
4. Head of adult female, seen from below. *a'*, antennule, *a''*, antenna, *mx''*, second maxilla. Between the bases of the antennules is the deflexed rostrum.
5. The mouth-cone, more highly magnified. L, labrum or upper lip, *l*, lateral lobe of lower lip, *md*, mandible.
6. Abdominal region of adult female, from below; p^5, fifth pair of thoracic feet, *o*, opening of oviduct.
7. Thoracic foot of second pair; *en*, endopodite, *ex*, exopodite.
8. Thoracic foot of fourth pair.
9. Larva of the earliest stage observed.
10. Third thoracic foot of same; *en*, endopodite, *ex*, exopodite.

Plate XIX.

11. Male in fifth Copepodid stage, from above. Appendages omitted.
12. Head of same, from below; *a'*, antennule, showing through the thin cuticle the segmentation of the adult stage, *a''*, antenna, *md*, mandible, *mx''*, second maxilla.
13. Antenna of same.
14. Abdominal region of same, from below; p^5, thoracic foot of fifth pair, *g.v.*, genital valve.
15. First thoracic foot of same; *en*, endopodite, *ex*, exopodite.
16. Third thoracic foot.
17. Fourth thoracic foot.



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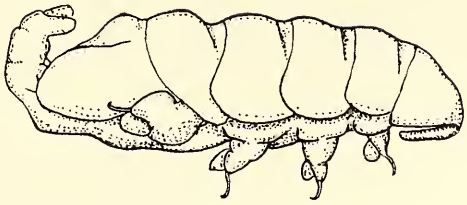

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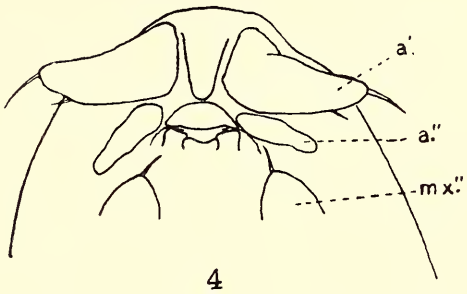

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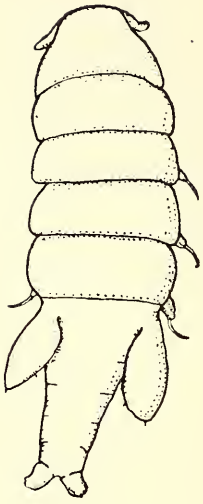

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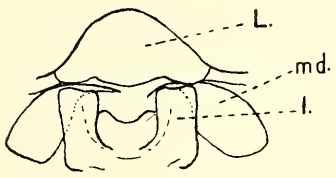

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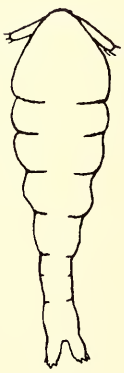

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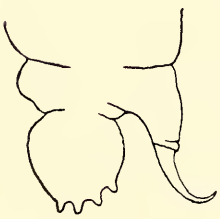

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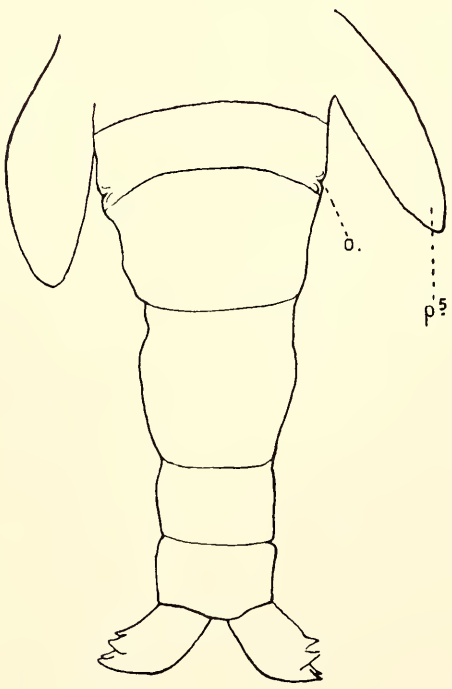

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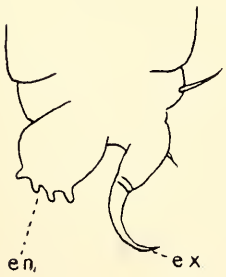

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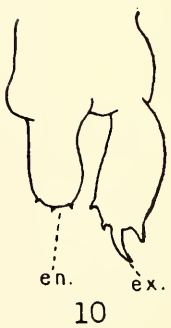

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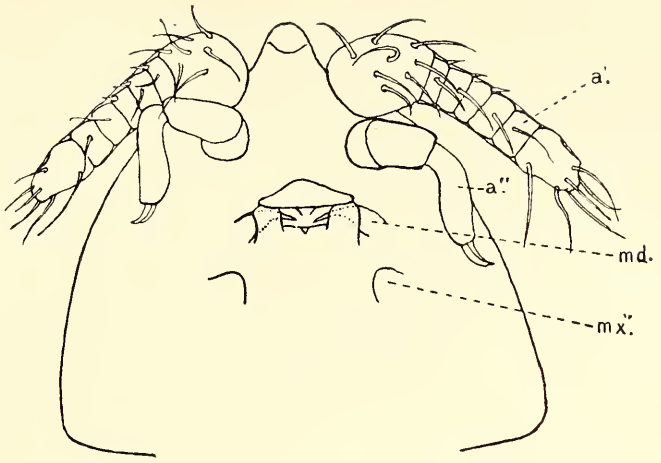
W. T. Calman, del.

ZANCLOPUS CEPHALODISCI.

(Female and young).



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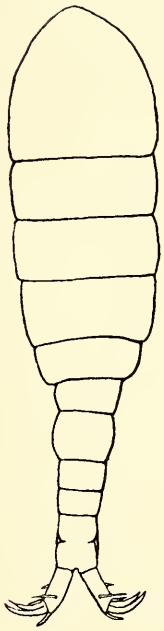

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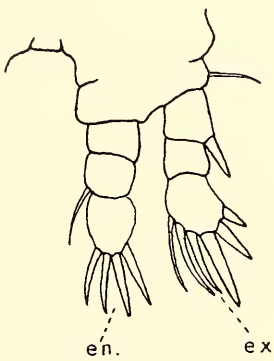

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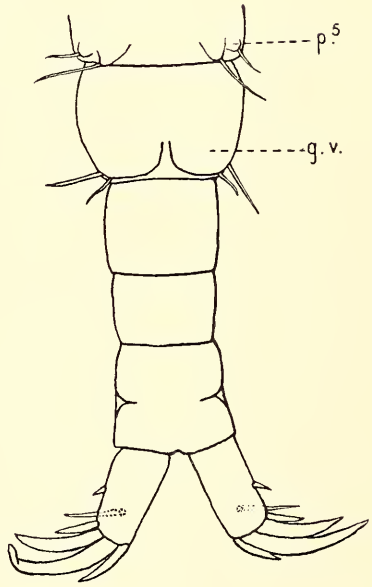

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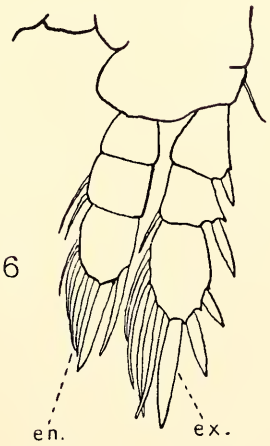

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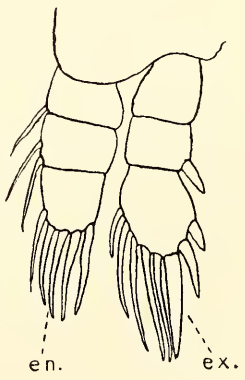


17

W. T. Calman, del.

ZANCLOPUS CEPHALODISCI.

(Male).

ON THE GENUS *BOTELLINA* (Carpenter), WITH A DESCRIPTION OF A NEW SPECIES.

By F. Gordon Pearcey,
Bristol Museum.

(Plate XX.)

INTRODUCTION.

In the year 1869 the late Professor H. P. Carpenter first described what was at that time considered the most interesting and largest known recent arenaceous *Rhizopod*, measuring 1 inch (25 mm.) in length, with the diameter of $\frac{1}{8}$ inch (3 mm.), judging from broken specimens, to which he gave the generic name *Botellina*, no mention being made of a specific name.

Since that time, however, a number of new arenaceous *Rhizopods* have been discovered fully $1\frac{1}{2}$ inches, or more; *i.e.*, *Syringammina fragillissima*,* from the Faröe Channel, in a depth of 555 fathoms; *Hyperammina palmiformis*,† also from the Faröe Channel, in 516 fathoms; *Reophax nodulosa*,‡ from the Antarctic and Pacific Oceans, in depths from 1,300 to 2,900 fathoms; *Pelosina variabilis*,§ and others.

In 1881 Dr. H. B. Brady redescribed the genus *Botellina* (from the same fragmentary specimens with which Professor H. P. Carpenter had made his description in 1869), and to which he gave the specific name *labyrinthica*,‖ reproduced and figured in the *Challenger* Reports, Foraminifera.¶ *Botellina labyrinthica*, Brady, was first obtained in some abundance at a single station (No. 51) on the third cruise of H.M.S. *Porcupine*, in 1869, at a point lying on the borderline, between the warm and cold areas of the Faröe Channel, at a depth of 440 fathoms, lat. 60° 6′ N., long. 8° 14′ W., bottom tempera-

* H. B. Brady, Proc. Roy. Soc., 1883, vol. xxxv., p. 155, pls. 2–3.
† F. G. Pearcey, Trans. Nat. Hist. Soc., Glasgow, vol. ii., pt. 2, new series, pl. 3, 1887–8.
‡ H. B. Brady, Chal. Reports Foraminifera, vol. ix., p. 294, pl. 31, figs. 1–9.
§ Ibid. pp. 235–236, pl. 26, figs. 7–9.
‖ Ibid., Quart. Journ. Micr. Sci., vol. xxi., new series, p. 48.
¶ Ibid. Chal. Reports, Foraminifera, vol. ix.

ture 42° F., and the surface water 51·6° F. It was again met with by the Naturalists of the *Knight Errant* and *Triton* Expeditions in 1880 and 1882, but always in a fragmentary condition in the same areas, at a depth of 516 fathoms in the warm area, and in 580 fathoms in the cold area, with a bottom temperature 46·5 and 31° F. respectively. It would thus appear to be more common in the cold area, where it was taken in the greatest abundance, strongly indicating that it favours a low temperature.

In 1886 Mr. Joseph Wright, F.G.S.,* again records *B. labyrinthica* as having been obtained in considerable abundance in a dredging taken about midway between Belfast Lough and Portpatrick, at a depth of 100 fathoms,† and again in September, 1902, from washings of dredged material from Rathlin Sound, Church Bay, in 17 to 24 fathoms, but he makes no mention of the temperature of the water. So far as I am aware, *B. labyrinthica* has not since been taken or recorded from any other locality.

Ten years later (in 1879), after its first discovery, I had the pleasure of examining some of the specimens of *B. labyrinthica* obtained by the *Porcupine* Expedition, which I considered at that time were merely fragments of an incomplete species, and mentioned the fact to the late Dr. H. B. Brady, who quite agreed with me. At that time he was preparing the *Challenger* Report; we also held similar views with regard to other arenaceous forms described and figured in that publication, viz., *Rhabdammina discreta*, *Hyperammina friabilis*, and others, as was proved by the discovery of a new and perfect species of *Hyperammina* (*H. palmiformis*), figured and described by me from the Faröe Channel.‡

In December, 1904, while occupied, under the direction of Sir John Murray, examining a series of marine deposits collected on board the Cape Government Zoological investigation vessel, ss. *Pieter Faure* (the late Captain Turbyne), off the N.E. and S.W. coasts of Africa, and in the vicinity of the Agulhas Bank, I observed several fragments of a large arenaceous Foraminifera, which I considered to be closely allied to Professor H. P. Carpenter's genus *Botellina*. These samples of deposit had been sent to Sir John Murray direct from the Cape of Good Hope, as they were obtained by dredge, or trawl, and placed in canvas or strong cotton-cloth bags, so that the general character of the samples as a whole

* J. Wright, Foraminifera from Rathlin Island, *Irish Naturalist*, vol. xi., pp. 211–213.

† Ibid., second dredging cruise of the ss. *Protector*. Belfast Nat. Field Club, 1886.

‡ F. G. Pearcey, on the Foraminifera of the Faröe Channel, Trans. Nat. Hist. Soc., Glasgow, new series, 1887–8, pp. 163–79, vol. ii., pt. 2, pl. 3.

could not at the time be made out. On closer examination, later, it was found that several of these samples were made up almost wholly of a beautiful arenaceous Foraminifera of large dimensions, with an erect robust test, and pinnate in form, measuring from $\frac{3}{4}$ inch to 2 inches or more in height, $\frac{3}{8}$ inch to $\frac{1}{4}$ inch in circumference, varying in colour from a brick-red to light and dark brown, or burnt-sienna, of which in previous samples I had examined I had obtained only small fragments. At two stations, Nos. 593 and 594, lat. 33° 50′ S., long. 25° 54′ 30″ E. in 26 fathoms, the samples from both of these stations were found to consist of a mass of this gigantic Rhizopod, sufficient to more than fill a half-gallon measure—enough, surely, to gladden the heart of the most ardent Rhizopodist.

Here, then, was sufficient material to work out the true character and position of the genus *Botellina*, of which hitherto fragments only had been discovered. I therefore decided to examine all the samples carefully with that purpose in view. The results of my study are depicted in the following pages.

Notwithstanding the large amount of material on hand, there were still serious doubts as to whether all or any of the specimens were really perfect.

In the great number afterwards examined, I found that the basal portion of each individual specimen (with three exceptions) showed a true and more or less clean fracture (see figs. 1, *a–b*, pl. 1), as if they had been broken sharply off from a basal attachment, showing clearly that they must have been, when living in their natural condition, attached to some foreign body on the sea-floor, or had possessed a large primordial chamber embedded in the deposit to support such a large test; although diligent search was made nothing of the kind was found, till a sample of deposit obtained off Cape Natal was examined, viz., Station No. 11,074, Cape Natal, N. $\frac{1}{2}$ W., distant $4\frac{1}{2}$ miles, at a depth of 55 fathoms. In this deposit, composed of a siliceous sand, containing a considerable percentage of shell and coral fragments, amongst which a number of the large *Botellina* were found, seven large oval, sublenticular, and subangular arenaceous chambers were obtained, showing a prominent elongation or tubular neck at one point, similar in composition, character, and colour to the large fractured, robust pinnate form previously discovered, which at once connected them with the incomplete arenaceous tests or *Botellina*, mentioned above, as taken in mass at Stations Nos. 593 and 594; indeed, with two or three of these chambers it was found possible, with scarce a doubt, to fit the fracture of the neck-like prolongations of these chambers to the fractures at the basal ends of the large pinnate branching

form, thus providing it with a primordial chamber (see Pl. XX., figs. 2–3). And although I have not found a complete or perfect specimen, viz., "the large pinnate test with a primordial chamber intact," there can be no doubt that these few large cells or chambers, taken in the same haul with the branching tests, of the same characteristic form and composition, their fractured tubular necks fitting as they do, in two or three instances, exactly the broken basal portions of the larger erect branching tests, are the primordial cells with which they were fixed on the sea-floor, and from which these beautiful erect pinnate structures were produced, as will be seen by the following detailed description, with figures showing fractured and restored specimens (Pl. XX., figs. 1, 2, and 3).

Family ASTRORHIZIDÆ.

Sub-Family RHABDAMMININÆ.

Genus BOTELLINA, Carpenter.

Botellina, Carpenter (1869). Butschli, Brady.

GENERIC CHARACTERS.

Typical Form.

(*Botellina pinnata*, Pearcey.)

Test free, arenaceous, erect, pinnate, rising from a primordial chamber, oval, subglobular, subangular, or compressed in form, with pseudopodial openings situated at the extremity of pinnate outgrowths; walls thick, of very firm consistence, subdivided into chambers which communicate freely into a main tubular chamber, running through the whole test, compactly cemented and generally smooth externally, in colour ferric brown of various shades. It is conspicuous amongst all other known Astrorhizidæ by its robust form and size.

Primitive Form.

(*Botellina labyrinthica*, Brady.)

Test arenaceous, cylindrical, straight or slightly curved, somewhat irregular in outline, one end rounded and more or less swollen (the natural condition of the other end not certainly known); walls of the test of firm consistence, rough, without external fine cement, subdivided irregularly by a labyrinth of sand-grains cemented

together at various angles forming rude chamberlets which open out into a main tube (or chamber), which runs through nearly the whole test.

Incomplete specimens only known.

DEFINITION OF NEW SPECIES.

Botellina pinnata, sp. nov.

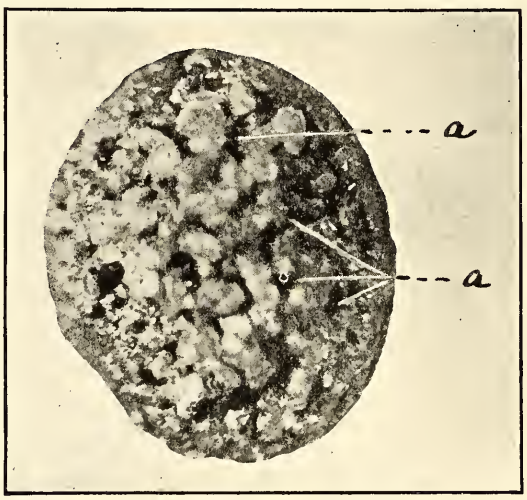
Test free, erect, arenaceous, comparatively smooth externally, tubular, in the form of a slightly compressed or rounded robust pinnate structure; the pinnate outgrowths rounded and slightly swollen, compressed or lobulated at their distal ends, with a series of pseudopodial apertures at the apex,—these are covered with a very fine, pale-coloured cement, from which (in the fresh state) numerous delicate transparent spicules project irregularly. Size, 1 to $2\frac{1}{2}$ inches (25 to 62 mm.) in height, with a diameter of $\frac{3}{16}$ to $\frac{3}{8}$ inch (3·5 to 6 mm.) rising from a basal or primordial more or less inflated chamber $\frac{3}{8}$ to about $\frac{1}{2}$ inch broad (9 to 12 mm.); oval, subglobular, subangular, or more or less compressed, from which arises a short cone-shaped neck before becoming divided into regular alternate pinnate outgrowths, which at times again divide into radiating branches or offshoots, but always retaining the pinnate character. Walls thick, of very firm consistence, finely cemented externally, and with minute chambers, which communicate into a main tubular passage running through the whole structure opening out freely, vestibular-like, into the pinnate outgrowths. Colour in various shades of red and brown, or ferric-brown.

The specimens on which the genus *Botellina* has been founded differ from all other known Astrorhizidæ, not only on account of its size, but in the general structure of its test, the walls of which are chambered, and therefore represents one of the highest types of structural development among the recent arenaceous Foraminifera.

In *Botellina pinnata* we have a well-defined method of building up the test; the main body of the test is composed of coarse materials. The walls are of firm consistence, $\frac{1}{16}$ to $\frac{3}{16}$ of an inch (35 to 10·5 mm.) in thickness, composed of siliceous grains, with a mean diameter of 0·5 mm., made up chiefly of *Quartz*, *Kircon*, and a sprinkling of *Glauconitic particles*, with an occasional *Garnet* or two, the whole incorporated by a siliceous and ferruginous cement. A thin layer on the exterior is more or less solid and imperforate, giving the whole structure a smooth and solid appearance. The

siliceous grains are so arranged in building up the wall that they form a network of minute chambers communicating freely with each other, and perforated with tubular-like passages opening out freely into a main central chamber, supplemented and strengthened at intervals by the extension of a portion of the walls into the interior; in the form of septa, constructed, like the remainder of the test, of cemented sand-grains (Pl. XX., figs. 8, 9).

These chambers, having free communication with each other, are generally quite filled with green sarcode, containing nuclear (?) corpuscles. Diameter of the central chamber variable (m. di. $\frac{1}{20}$ inch = 1·26 mm.), internal chitinous lining absent. The pseudopodial apertures are situated at the extreme or peripheral ends of the pinnate outgrowths (see woodcut), formed sometimes of three or



Front view of a peripheral end of one of the pinnate outgrowths of *Botellina pinnata*, sp. nov., after it has been treated with dilute hydrochloric acid. Magnified 12 diameters; *a*, *a*, pseudopodial apertures.

four transverse slits, or more generally of irregular spaces between the agglutinated sand-grains. These apertures are almost closed in with a light brown cement made up of carbonate of lime and ferruginous material, from which extend minute transparent spicules also formed of carbonate of lime, produced to all appearance by the organism itself as a protective agent. These portions are of a much paler colour than any other part of the test, due to a higher percentage of lime at these points than elsewhere, giving a bright and life-like effect to the whole structure.

On the test being laid open longitudinally, the main central chamber is seen to start from a large primordial cell, from whence a main passage runs through the whole structure, branching off into

vestibular-like passages to the pinnate outgrowths; the septa from the inner walls are exposed, as also the foramina, or tubular communications to the wall chambers which open out into it, shown in Pl. XX., figs. 8, 9, 10 and 11, *a*, *b*, *c*.

The same figures show the wall chambers, by means of microphotography, of the actual specimens, which are not accidental lacunæ, but in a measure regularly constructed; the sand-grains which form their walls are fixed to each other by a siliceous compound, and are arranged in a more or less orderly fashion, so as to form a labyrinth of minute chambers.

A transverse section across one of the pinnate outgrowths (Pl. XX., fig. 9) magnified twelve diameters shows the wall chambers more clearly. In this figure the thickness of the walls indicated; also the fine thin layer of siliceo-ferruginous cement, *d*, which contains about 2 per cent. of carbonate of lime, and forms the final outer coating of the walls.

The wall of the primordial cell is chambered in a similar manner to that of the remainder of the test (Pl. I., fig. 8*b*). It possesses one large, or from two to five small pseudopodial (?) openings (figs. 1–3 and 7*e*); oval, or slightly projecting outwards along the edge of its basal portion, which, when living, is most probably buried in the deposit on the sea-floor, and by which means it is enabled to support or anchor the large, erect, robust test.

The junction, or neck, connecting the distal portion of the test with the primordial chamber, being the weakest point of the whole structure, will doubtless account for so many imperfect specimens being taken by means of the trawl and dredge, minus the primordial chamber.

CONCLUDING REMARKS.

Dr. H. B. Brady, in his description of *Botellina labyrinthica*, gives its specific name evidently on account, as he states, of the interior of the tube being subdivided irregularly by a labyrinth of coarse sandy particles, except at the rounded terminal cavity (?) which forms an undivided chamber. And, later on, he states that the test has the appearance of a cylindrical tube of a somewhat irregular diameter, one end rather swollen and rounded, the other end always imperfect, apparently broken. At the broad end, the investment is thin and incomplete, and there are many orifices (*chambers*) * left between the sand-grains; and this fact, together with the broken condition of the specimens, gives rise to the supposition that when

* The italics are my own.

living the test is erect and sessile, growing attached or rooted by its narrow extremity to some fixed base, and that the interstitial orifice of the terminal chamber serves as the general aperture.

It would appear quite evident from the above that the late Dr. Brady was cognisant of the true character of this interesting rhizopod when in its perfect living condition, although no definite mention is made of the chamber walls; it must be borne in mind that he had but incomplete fragmentary specimens to deal with; the fact that he mentions the many orifices left between the sand-grains, and the interior of the tube (or central *chamber*)* in parts being subdivided, is, I take it, an admittance that he saw the primitive arrangement of chambers in the walls of the test.

Again, the late Dr. H. C. Carpenter (*loc. cit.*) states that the cavity of the tube is not divided into chambers by interposed septa, as in the genus *Reophax;* but it is continuous throughout, though traversed in every part of its length by irregular processes, which goes to prove its close affinity to the structure of the chambered walls of *Botellina pinnata.*

Neither Dr. Carpenter nor Dr. Brady mentions any special formation of chambers by the sand-grains in the building up of the walls of the test (except the irregular processes traversing the whole length of the tube (?)), from which it would be inferred that they both saw, at least in some of the fragments examined by them, a central continuous tube, or main chamber in direct communication with the interstices, cellular, or chambered wall structure. I have examined some of the actual specimens or fragments from which Messrs. Carpenter and Brady made their descriptions, and these show definite indications of chambers in the walls of the test, with inter-communications with the main chamber, resembling that of *B. pinnata*, but the fine material which forms the outer coating and gives the smooth and solid finish to the outer surface of the whole test of *Botellina pinnata* is altogether wanting in *B. labyrinthica;* still, I consider there is sufficient generic similarity to retain the new species under the genus *Botellina* founded by the late Dr. H. P. Carpenter, although on first acquaintance there is a strong desire to form a new genus, which, however, is lost sight of on structural examination of the tests of each species.

I wish here to thank my friend Mr. J. W. Tutcher, of Bristol, for the energetic manner in which he undertook the difficult task of producing by micro-photography figs. 8–11 on the Plate.

* The italics are my own.

List of Stations, with Localities, &c., from which *Botellina pinnata* have been obtained.

Number of Station.	Latitude.	Longitude.	Depth in Fathoms.	General Remarks.
547 and 548	33° 54′ 13″ S.	25° 53′ 30″ E.		*B. pinnata*, moderately common.
580	34° 1′ 30″ S.	25° 45′ 00″ E.		Two large specimens and fragments.
593 and 594	33° 50′ 00″ S.	25° 54′ 30″ E.		*B. pinnata*, in mass. These two samples fully filled a half-gallon measure of *B. pinnata* alone. In this sample were also obtained a few irregular perforated slabs of agglutinated shelly sand, overgrown with *Serpula*, *Polyzoa*, *Coral*, *Hydrozoa*, and *Foraminifera*, *Gasteropod*, and *Lamellibranch* shells, shell fragments, and siliceous sand.
781	33° 53′ 00″ S. (Off East about 17 of East	28° 12′ 00″ E. Beacon, miles E. London.)	45	Quite 2 lbs. in weight of *B. pinnata*, with a few *Gasteropods*, *Polyzoa*, and a mass of a large *Hydroid* (*Sestularia?*), sand and shell fragments. The *B. pinnata* taken in this haul are of a bright red colour.
805 and 806	33° 3′ 00″ S.	27° 57′ 00″ E.	32	A good many *B. pinnata*, brown and bright red in colour.
826 and 827	36° 6′ 45″ S.	27° 55′ 45″ E.	43	About 6 lbs. in weight of material, composed of sandy mud and shells, with hardened lumps of homogeneous mud. *B. pinnata* moderately common.
1,108 and 1,109	Bird Island Algoa	Passage, Bay.	10 to 16	A few specimens and fragments of *B. pinnata*, and a number of a smaller species, nov.
1,882	Cape St. N. by E., 73	Blaize, distant miles.	125	Several fragments.
10,778	Cape W. ¾ N., 12½	Natal, distant miles.	85	A few fragments of *B. pinnata*, with a number of specimens of a smaller species. Bottom deposit, a coarse sandy mud.
11,074	Cape Natal, 4½ miles	N. ½ W., distant.	55	This deposit, composed of a dead coarse shelly sand and coral fragments containing a number of ferric-brown phosphatic concretions, among which was found a good number of *B. pinnata*, and seven large primordial chambers belonging to them, together with many other large foraminifera, as *Polytrema rubra*, *Rupertia* sp. nov., *Astrorhiza* sp.? *Cristellaria*, &c.
10,834	Umhlote mouth, W. ½ W., 8½	River N. by distance miles.	40	A number of highly coloured *B. pinnata*, and some fragments of a smaller species, nov.
11,188	Mouth Umkomaas N.W. by distant	of the River. W. ½ W., 5¼ miles.		*B. pinnata*, in mass. Nearly a quart measure full, many with incrusting *Polyzoa*, with a great quantity of a large *Hydrozoa* (*Tubularia*? sp. ?), worm tubes, free *Polyzoa*, *Gasteropods*, and *Lamellibranchs*, with a quantity of shelly sand, shingle, and coral fragments.

EXPLANATION OF PLATE XX.

Botellina pinnata, sp. nov.

FIG.

1. *a*, Branching form, showing three offshoots from one primordial chamber; *b*, primordial chamber detached from the main test by the trawl when captured; slightly enlarged.

   The fractured parts, *c c*, shown in this figure were found to fit each other exactly; *e*, pseudopodial (?) apertures. Station 11,074; off Cape Natal; depth, 55 fathoms.

2–3. Typical forms of *B. pinnata*, with primordial chambers restored; the pseudopodial apertures are shown armed with delicate spicules; *e e*, pseudopodial (?) apertures. Station 11,074.

4. A somewhat compressed form, with double branching of pinnate outgrowths; primordial chamber broken off from distal portion of test; slightly enlarged. Station 593–594.

5. A double branching form minus the primordial chamber; slightly enlarged; this form of test was found comparatively common. Station 781; depth, 45 fathoms.

6. Specimen from Station 805–806, showing new offshoot from an old fracture of the test; natural size.

7. Detached primordial chamber before being ground down to show the interior and wall chambers; natural size; *e*, pseudopodial (?) apertures.

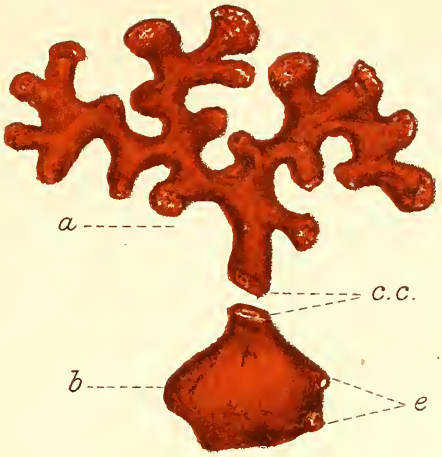
8. Detached primordial chamber (fig. 7), after a portion of one side has been ground away longitudinally; (microphoto) magnified 4 diameters; *a*, interior of main chamber; *b*, wall chambers; *c*, elongated neck showing tubular passage communicating to the upper portion of the main test and pinnate outgrowths; *d*, external covering of cement.

9. Micro-photograph of a transverse section across one of the pinnate outgrowths; magnified 12 diameters; *a*, main passage which forms the direct communication to the primordial chamber; *b b*, septa; *c*, wall chambers; *d*, thin layer of cement which forms the outer coating of the test.

10. Micro-photograph of a part longitudinal section of a portion of the test, magnified 4 diameters; *a*, main passage; *b*, tubular openings from the wall chambers into main passage; *c*, wall chambers exposed after external coating of cement has been removed.

11. Micro-photograph of a longitudinal section of two of the pinnate outgrowths showing numerous openings from wall chambers; *a a*, pseudopodial apertures. (See also woodcut, p. 190.)

2.



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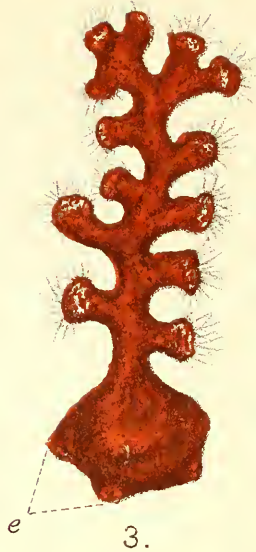

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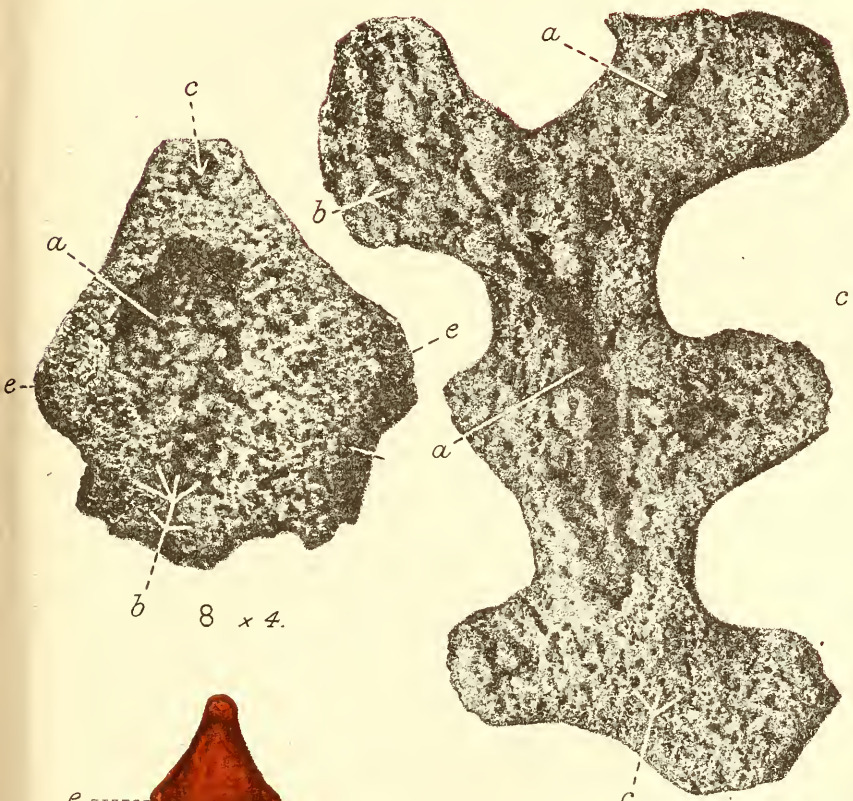

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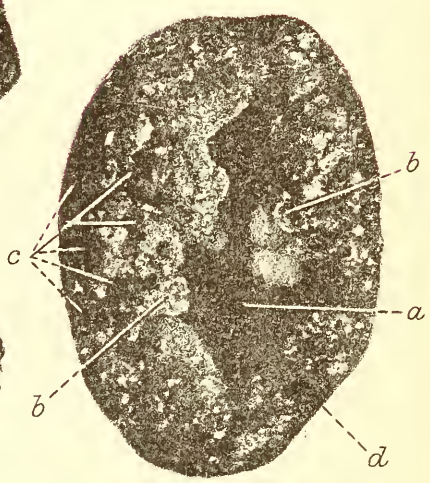

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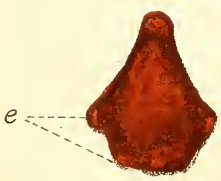
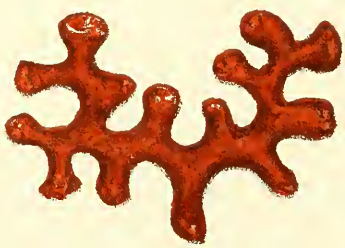


7.

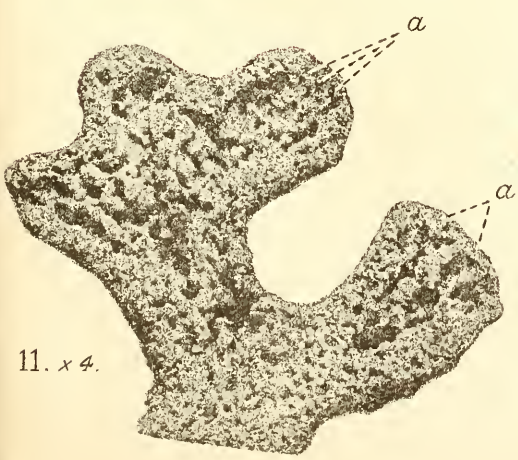
10. x 4.

4.

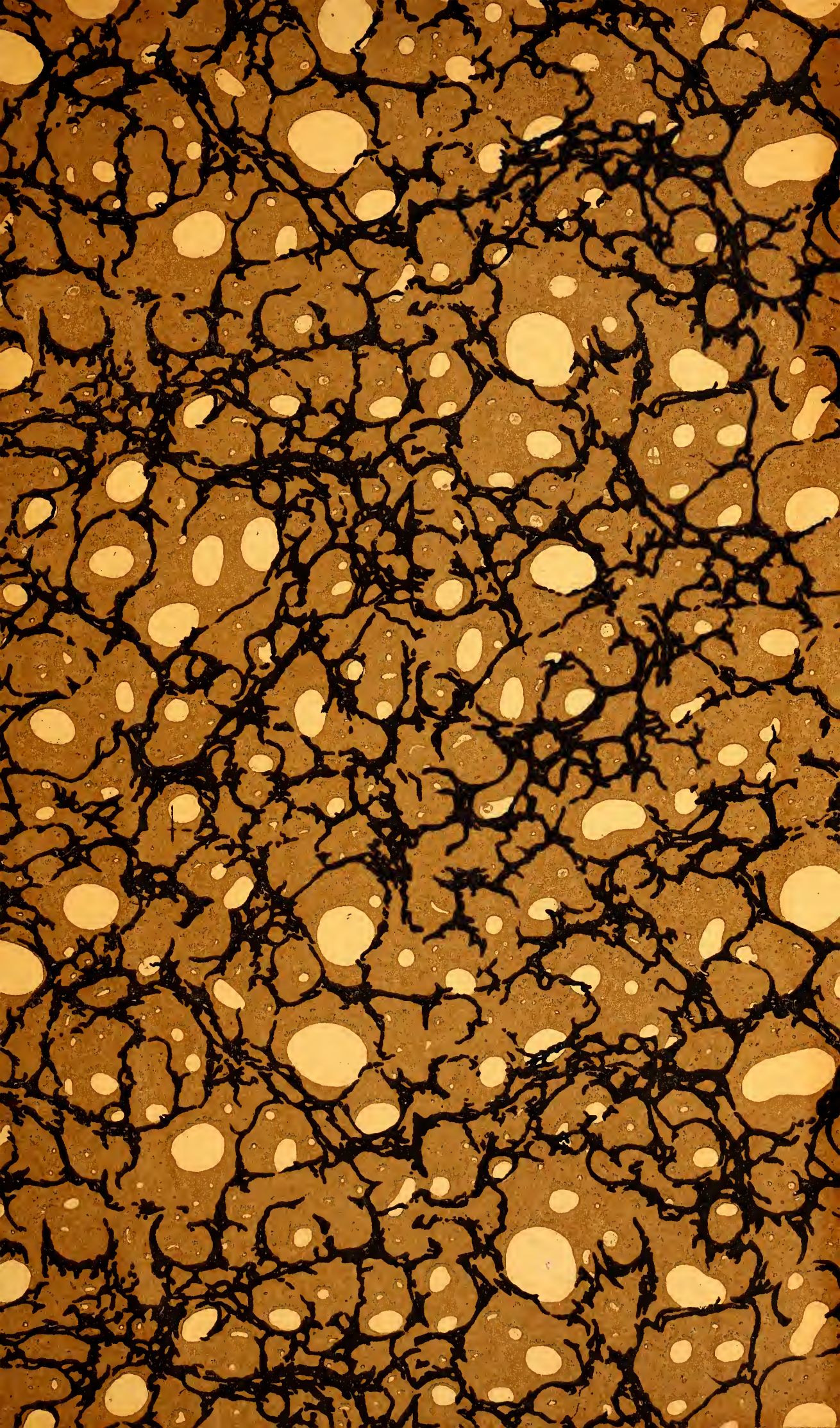


5.

6.



11. x 4.

West, Newman lith.

BOTELLINA PINNATA *Sp. nov.*